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UNITED STATES AIR FORCE

PROJECT FORNCAST

INTELLIGENCE AND CRYPTANALYSIS

REPORT

VOL II

JANUARY 1964

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SECRET 5412B

This is the report of the Intelligence and Reconnaissance
Panel Chairman of the Director of Project FORECAST.
The report contains the findings and recommendations
of the panel as approved by the Chairman, but does not
represent the opinions of the Project FORECAST Director.
The findings of this panel are presented in his
panel report. Specific data and figures in this report
concerning Russia, Germany, or Italy are to be
reviewed and verified only and not as general information.

O. J. ...
Major General, USAF
Chairman, Intelligence and
Reconnaissance Panel
Project FORECAST

TO ORDER TO INSURE SECURITY AND PROTECT THE UNITED STATES, THE UNITED STATES INTELLIGENCE AND SECURITY AGENCIES HAVE BEEN PUBLISHED IN THE FOLLOWING THREE SEPARATE BOARD VOLUMES:

Volume I	Section I	Intelligence and Security	Top Secret, Restricted, Confidential
Volume II	Section II	Intelligence and Security	Secret
Volume III	Section III	Supplementary Data	Top Secret, Restricted, Confidential
	Annex A	Intelligence and Security	Secret
	Annex B	Intelligence and Security	Secret
	Annex C	Intelligence and Security	Secret
	Annex D	Intelligence and Security	Secret

Section II of the overall intelligence and security panel final report is presented in this document. This document was prepared in conjunction with the intelligence and security panel final report conducted by the panel.

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This document presents an analytical examination of the technological, electrical, and mechanical aspects of the sensor, data transmission, data processing, data storage, data retrieval, and sensor integration technology. The document also discusses the relationships of these present sensor technology, current problem areas, and future trends and anticipated developments in the field of sensor technology. The document also discusses the current status of sensor technology, and future trends and anticipated developments in the field of sensor technology. The document also discusses the current status of sensor technology, and future trends and anticipated developments in the field of sensor technology.

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1. PURPOSE AND SCOPE

The objective of this report is:

- 1) To assess the current status of the technology which supports intelligence and defense systems and vehicles.
- 2) To predict the trends of potential future developments in the technology which supports intelligence and defense systems and vehicles.
- 3) To determine current research and development efforts.
- 4) To recommend changes to current research and development efforts.
- 5) To recommend new research and development efforts to be initiated in the future.

Intelligence and defense systems are dependent on the state-of-the-art in data collection, data processing, data storage, data communication, and data display. This report is a survey of the state-of-the-art in these areas, with particular emphasis on the state-of-the-art in data collection, data processing, data storage, data communication, and data display.

2. Approach

For purposes of the following discussion, the technology and resources of intelligence technology are divided into the following categories: photography, electronic warfare, directed energy, and vehicles. The state-of-the-art in these areas is discussed in terms of current research and development efforts, and recommendations are made for future research and development efforts. The state-of-the-art in these areas is discussed in terms of current research and development efforts, and recommendations are made for future research and development efforts. The state-of-the-art in these areas is discussed in terms of current research and development efforts, and recommendations are made for future research and development efforts.

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5. Overall Technical Objectives of the Program

The overall technical objective is to develop a low cost, lightweight, and reliable sensor program that will be able to detect and identify threats in a very complex environment with a high probability of success. The program will be able to detect threats from a wide range of angles and distances.

- 1) Sensitivity of passive sensors to detect and/or identify threats from a wide range of angles and distances.
- 2) Time cycles from sensing to the detection of threats.
- 3) Quality and speed of identification of threats.
- 4) Capability to identify one or more threats when a single subsystem is lacking.
- 5) Improved resolution of all sensor sensors and improved signal-to-noise ratio of all non-inertial sensors.
- 6) Capability to operate under adverse environmental conditions.

6. Recommendations

The following sections on Support of Technology and Technology Advancement are recommended:

- 1) Increase funding for exploratory development by 5% over the present funding for a total of \$3.5 million per year.
- 2) Increase advanced development to a total of \$17.5 million per year.
- 3) Construct advanced facilities and further work on the program at a cost of approximately \$17.5 million.

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Calculus, B. S. 1955

Photography is considered a prime sensor in its own right, and is also a valuable technique that lends itself to incorporation into other reconnaissance-sensor subsystems for data processing, recording, and storage. The most important factor in a reconnaissance system is the ability to obtain high resolution, high contrast, and high speed photography. To obtain this resolution, contrast, and speed, the system must be able to obtain high resolution, high contrast, and high speed photography. The most important factor in a reconnaissance system is the ability to obtain high resolution, high contrast, and high speed photography. To obtain this resolution, contrast, and speed, the system must be able to obtain high resolution, high contrast, and high speed photography.

At present, the following illuminants are available for use in reconnaissance photography and are available for use in reconnaissance photography. The following illuminants are available for use in reconnaissance photography and are available for use in reconnaissance photography.

- 1) Flashbulbs up to approximately 30,000 ft.
- 2) Flash cartridges from approximately 1000 to 7000 ft.
- 3) Flash lamps up to approximately 2000 ft.
- 4) Flash bulbs up to approximately 3000 ft.
- 5) High-pressure mercury vapor lamps (2000 ft. light) up to approximately 5000 ft.
- 6) Magnesium flares up to approximately 3000 ft.

Inasmuch as most of the foregoing illuminants are not suitable at high speeds, work is underway on adapting lasers for this purpose. Also, more study of new illuminants is required.

Although photography today is considered a prime sensor in its own right, it is also a valuable technique that lends itself to incorporation into other reconnaissance-sensor subsystems for data processing, recording, and storage.

[illegible]

High- and Low-Income Leverage Practices

[illegible]

b. Electromagnetic Spectrum

A trend toward utilizing more of the short-wavelength spectrum in photography will be apparent. It is expected that IR photos obtained primarily on a basis for establishing a very excellent capability in spotting work in an effective means for obtaining target rays at low altitudes. This new IR, perhaps out to 1.5 microns, will be useful in advanced camouflage detection film and target de-

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Module III-2: Registration Database Reception

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Figure II-1. Approximate Resolution Trend Low Light Level Sensing.

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Figure II-2. Approximate Logarithmic Resolution Trend, Photographic Systems

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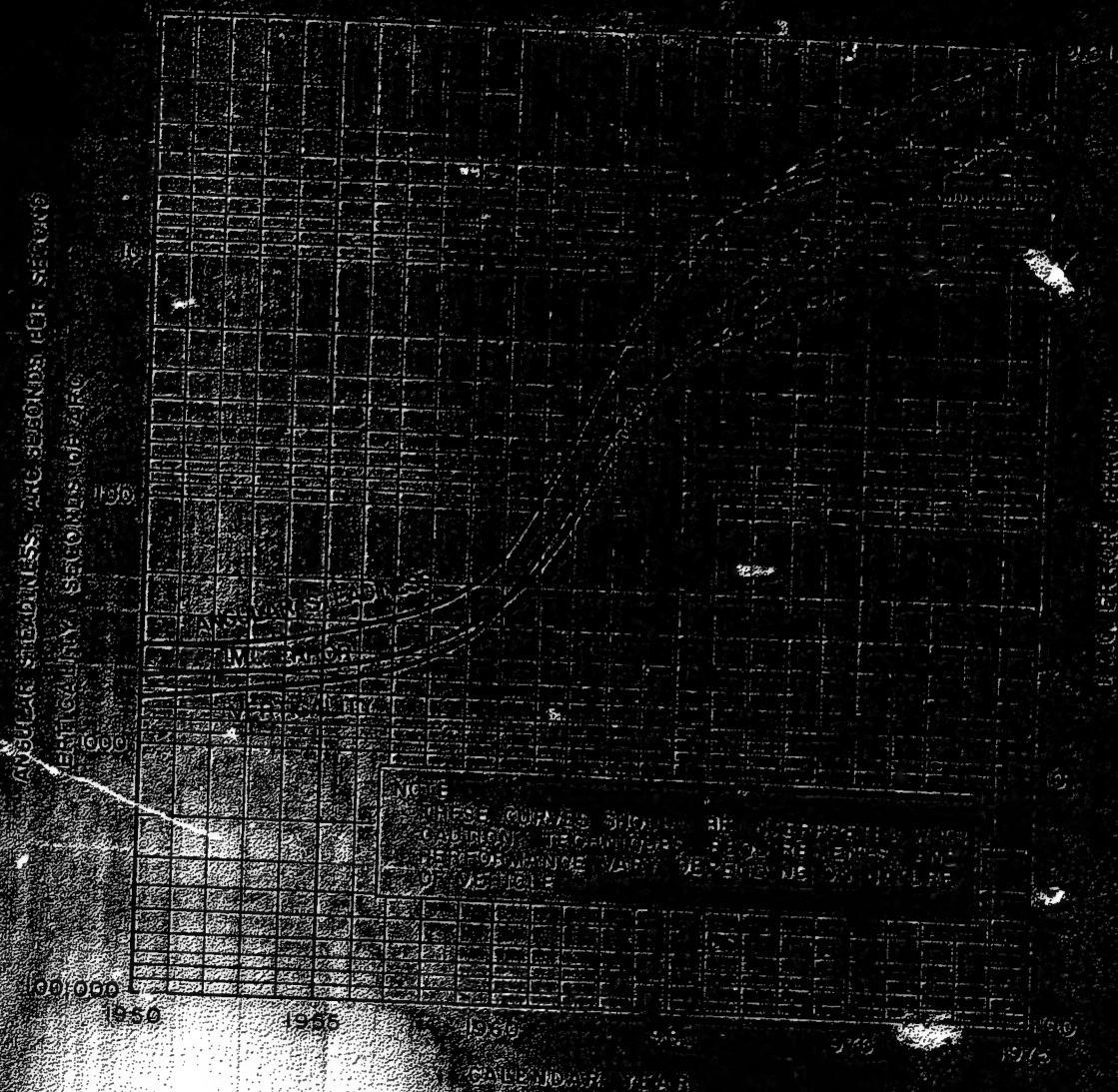


Figure II-3. Error Trend, Angular Stability, Verticality, and Image Noise Control

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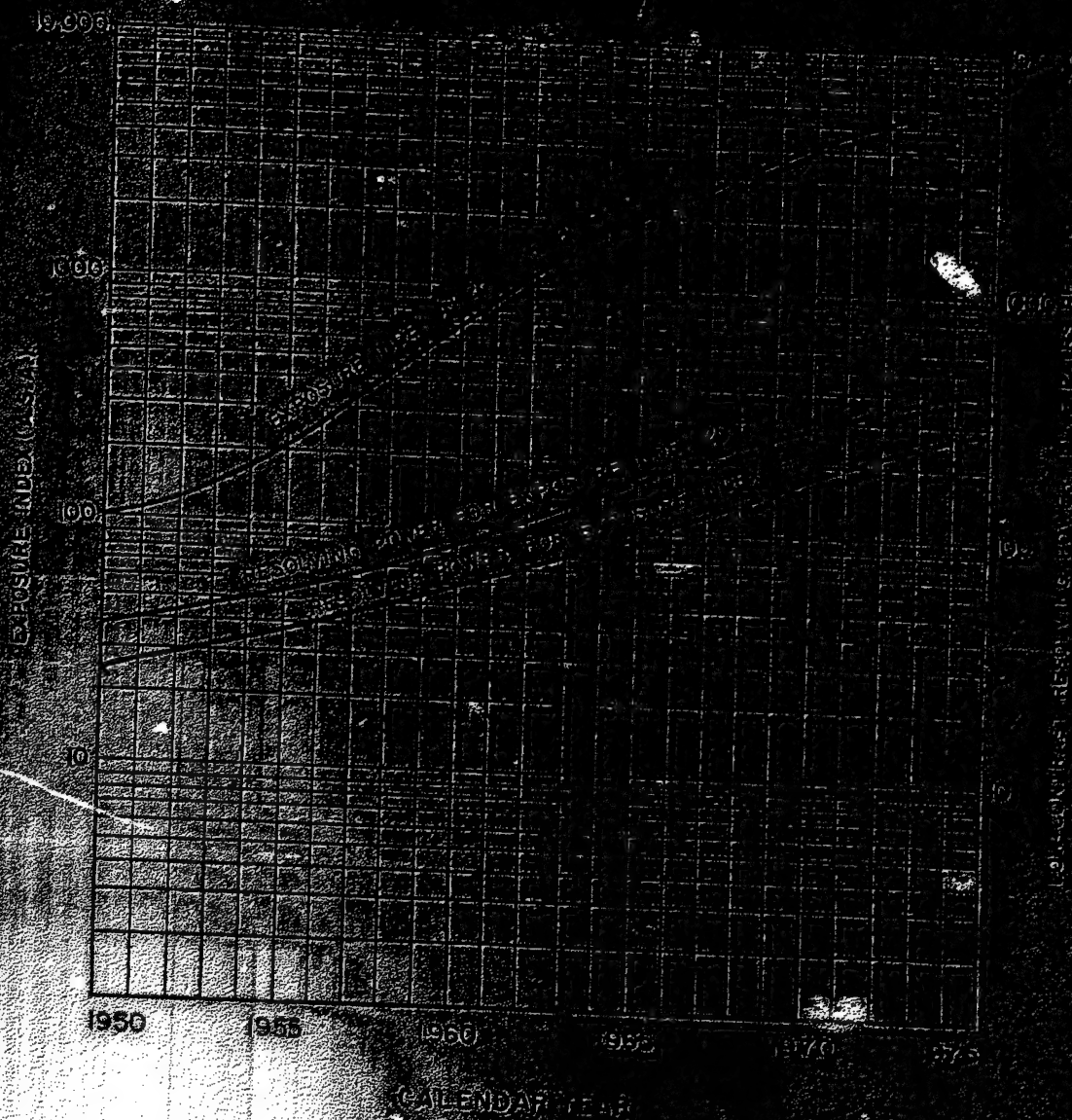


Figure II-4. Approximate Resolution, Power, and Exposure Index Trends, Photocopyable Sensitized Receivers

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- 1) Nighttime photography, with the advent of new light sources, particularly in the area of infrared, and the detection of light amplification, and the use of color film in photography should be developed.
- 2) Wide-spectrum camera and film systems, covering the ultraviolet (UV) to near-infrared (NIR) spectrum.
- 3) Atmospheric conditions or weather-related effects on haze, particularly for night.
- 4) New lens designs, optical glass technology, and computer-aided control, test, and evaluation techniques.
- 5) Camera controls capable of providing better film, mechanical, pointing, focusing, shutter, and viewing mechanisms.
- 6) Higher-resolution detectors, more sensitive silver halide films, and new unconventional materials to provide real-time imaging, dry processing, multi-sensor, very sensitive, and high resolution.

Photo-subsystem analysis and evaluation should be conducted on both theoretical and experimental basis with emphasis on new diagnostics and measurement techniques and on optimization of trade-offs.

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Although the foregoing work is currently underway, funding and the number of man-years and dollars are limited by the fact that the program is currently \$1,750,000.

B. Advanced Development

Advanced development programs include the following: development of advanced photo subsystems and the development of the development of the advanced development program from the current program. The following advanced development programs are being planned:

- 1) Night vision system for use in the development of advanced photo subsystems and the development of the development of the advanced development program from the current program. Such systems could provide an advanced photo mode in real time display and an advanced photo mode in real time display. Total cost would be on the order of \$5,000,000.
- 2) A night vision system for use in the development of advanced photo subsystems and the development of the development of the advanced development program from the current program. Such systems could provide an advanced photo mode in real time display and an advanced photo mode in real time display. Total cost would be on the order of \$3,000,000.
- 3) Low-altitude high-speed photo systems for use in the development of advanced photo subsystems and the development of the development of the advanced development program from the current program. Such systems could provide an advanced photo mode in real time display and an advanced photo mode in real time display. Total cost would be on the order of \$750,000.
- 4) A high-speed photo system for use in the development of advanced photo subsystems and the development of the development of the advanced development program from the current program. Such systems could provide an advanced photo mode in real time display and an advanced photo mode in real time display. Total cost would be on the order of \$1,000,000.
- 5) A multipurpose photo system for use in the development of advanced photo subsystems and the development of the development of the advanced development program from the current program. Such systems could provide an advanced photo mode in real time display and an advanced photo mode in real time display. Total cost would be on the order of \$1,000,000.

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2. MICROSCOPY

The early optical microscopes of the past had been constructed with care and precision using glass lenses and mirrors. The resulting images were in the visible region of the spectrum. However, the development of the electron microscope was motivated by the possibility of obtaining higher magnification than was possible with optical microscopes. Electrons, which have a much smaller wavelength than light, can be focused on a specimen and the resulting image can be recorded on photographic film. The electron microscope has been developed to such an extent that it can now be used to study the structure of materials at the atomic level. This method is similar to that of the optical microscope, but the photocathode is replaced by a more sensitive electron source.

Another family of related devices is called electron microscopes. These are aligned and use light sources for producing electron beams. The electron beams are focused by magnetic lenses and the resulting image is recorded on photographic film. These devices are used to study the structure of materials at the atomic level. The electron microscope has been developed to such an extent that it can now be used to study the structure of materials at the atomic level. This method is similar to that of the optical microscope, but the photocathode is replaced by a more sensitive electron source.

The discussion of photocathode microscopes presented in Section II-A also applies to electron optical systems. Any electron optical system which produces an image of an object on a photocathode is called an electron optical system. These systems are used to study the structure of materials at the atomic level. This method is similar to that of the optical microscope, but the photocathode is replaced by a more sensitive electron source.

- 1) Photocathode Microscopes: Photocathode microscopes are used in electron optical systems. They are similar to optical microscopes, but they use a photocathode to produce an image. They are used to study the structure of materials at the atomic level. This method is similar to that of the optical microscope, but the photocathode is replaced by a more sensitive electron source.
- 2) Image Orthicon: Image orthicon tubes are used in electron optical systems. They are similar to optical microscopes, but they use an image orthicon tube to produce an image. They are used to study the structure of materials at the atomic level. This method is similar to that of the optical microscope, but the photocathode is replaced by a more sensitive electron source.

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Electro-optical techniques provide the advantage of a real time video display, although the problem of linear energy characteristic distortion and deterioration of geometric fidelity. Also advantageous is that the image is in electronic form, and therefore is amenable to transmission over a data link or to electronic data processing to improve quality or reduce redundancy. Readout video bandwidths of 10 to 20 Mc are possible. Techniques have been developed for processing complex image characteristics such as clouds and industrial complex shapes with satisfactory results. (Ref. Section II.G).



Figure II-5. Approximate Resolution Trend,
 The Office of General Subsystems

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Trends reflecting the development of electronic optical communication and devices are illustrated in Figures 11-3 and 11-4. Much progress has been made in the development of image-oriented optical communication systems, and optical storage systems which incorporate optical wave guides, advanced non-volatile memories, and image data processing, as is schematically illustrated in Figure 11-5. In comparison with early manifestations of image communication, it is shown in Figure 11-6 that of these curves, progress toward realization of the possibilities beyond 1967. However, the progress made over the last time will depend on resources advanced (both manpower and money) and requirements. A great deal is expected of the field of image storage, laser, etc. Optical radar is a significant possibility by 1970, and it may be possible to apply this technique to the problem of underwater and marine detection. Trends in this field moving from are difficult to predict at this time.

3. Problems

Future development of electro-optical communication devices will depend to a large degree on discoveries and studies in solid state devices, better materials with suitable characteristics for high resolution and sensitivity as well as techniques for controlling electron beams in very small spot sizes for high resolution and generation of very high power lasers having fast pulse repetition rates also are needed. Improving methods for consistently producing high performance devices and materials are another problem area.

4. Emphasis

a. Exploratory Development

Exploratory development of improving photo-type resolution and sensitivity should be continued and various techniques for producing high resolution hard-copy prints requires further work. Additional exploratory development to improve light amplification and image discrimination devices and techniques should be conducted using both the image tube and the image orthicon approach. New techniques for image enhancement, discrimination, and data filtering with spectral and spatial filtering should be investigated. New applications of photo type in image storage and processing techniques should be examined for application to other sensors such as IR and radar. Development of applicable laser techniques, both CW and pulsed, should be accelerated, and the search for laser tubes to match the single frequency of a laser light source should be emphasized.

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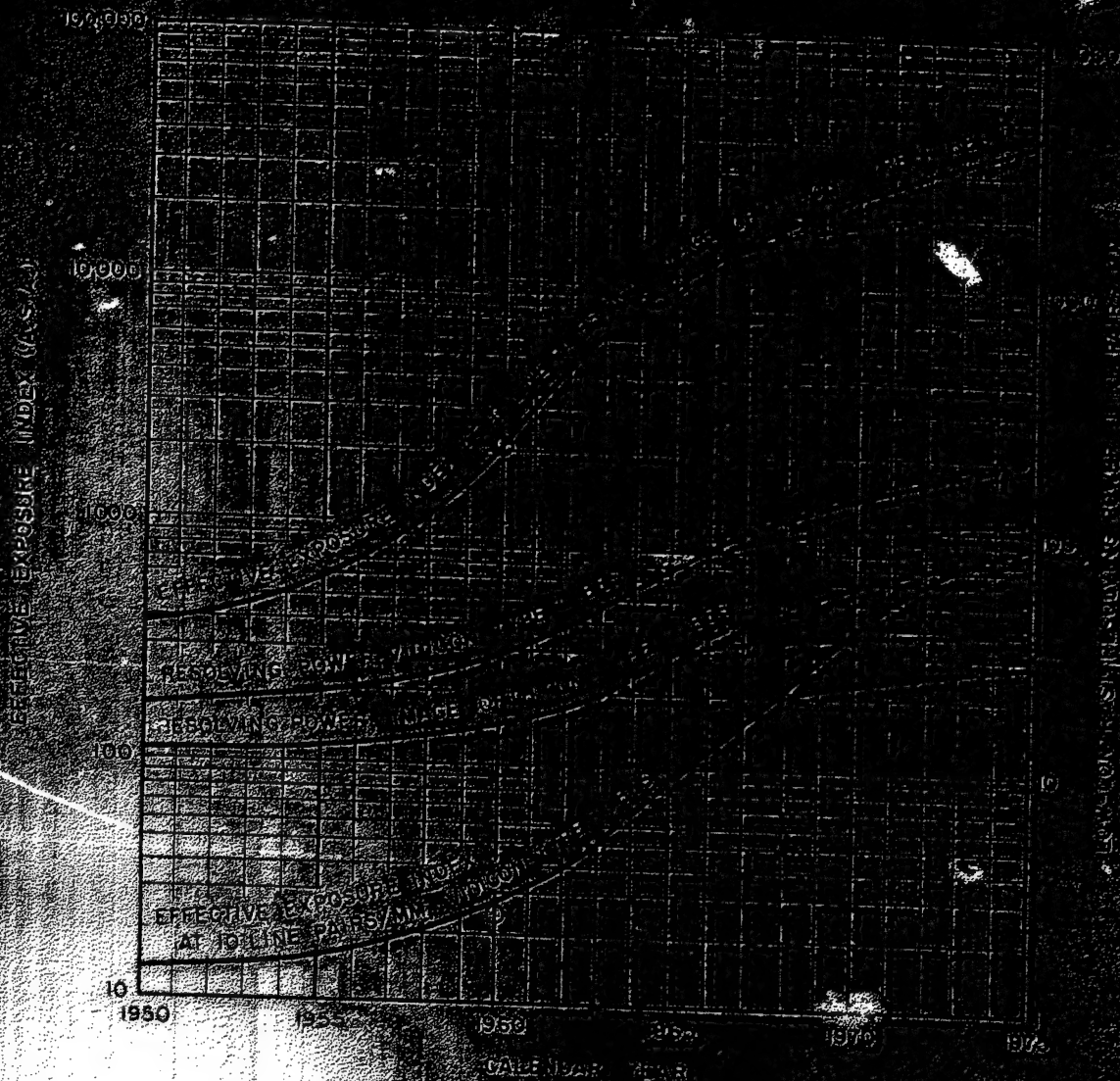


Figure II-6. Approximate Exposure Index and Resolving Power Trends, Image-Orthicon and Vidicon-type Tubes

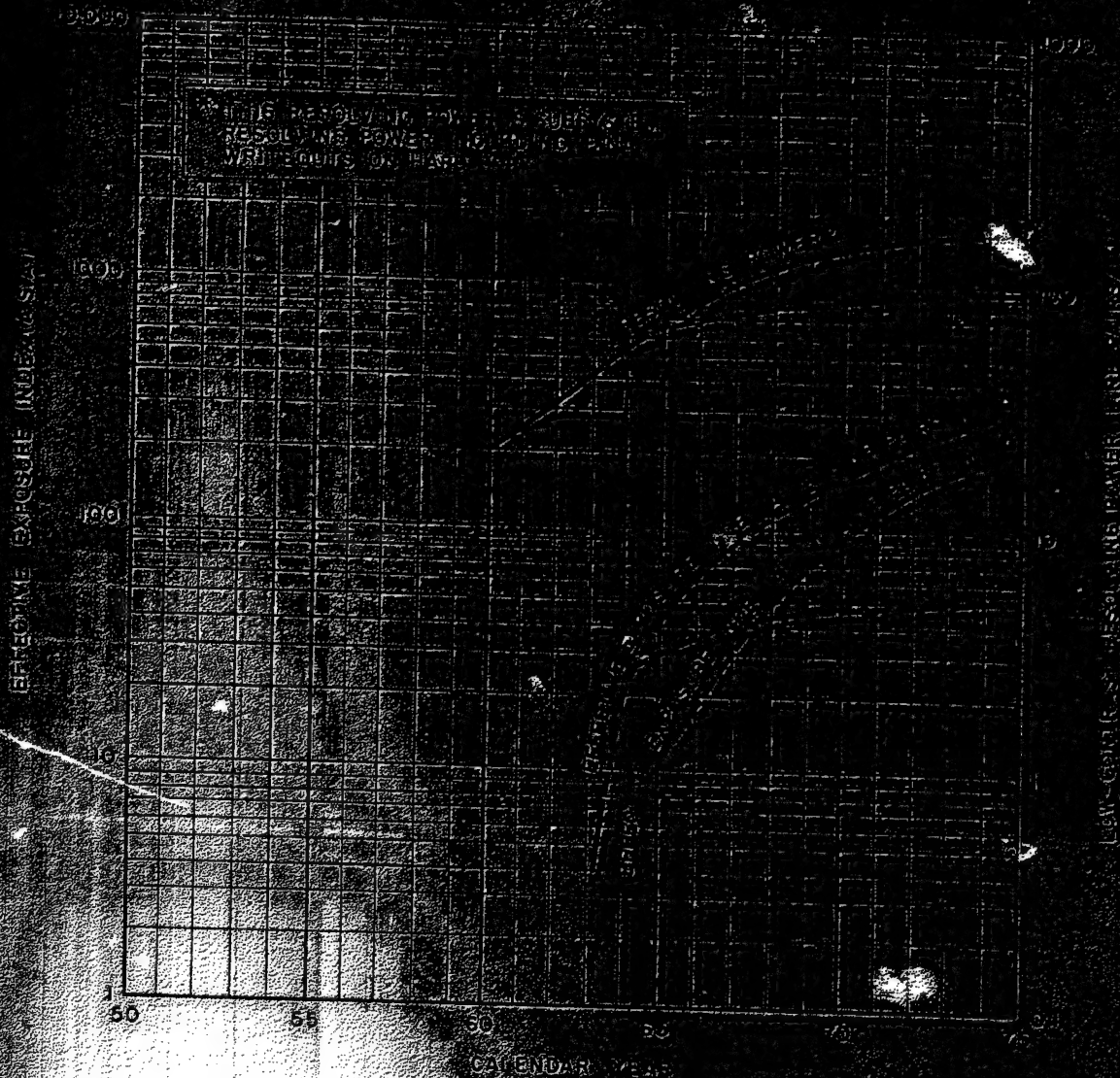


Figure II-7. Approximate Exposure Index and Resolving Power Trends, Electro-Optical Photo Tape.

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Although work in the above areas is currently progressing, funding and progress should be increased to at least \$100,000, or approximately \$50,000.

Advanced Development

Investigation of the following advanced development work should be carried on and progressed until such time as all these systems are ready and ready for service.

- 1) Low-light-level image tube camera with an image intensifier that would provide a near-real-time camera system for use in the field of view. Advanced development work should be carried on until such time as a camera system could be employed. Camera tubes that are currently covered in the enclosed areas are being considered ready for advanced development. Work should be of the order of \$2,000,000 and be completed.
- 2) A photo-type camera with a near-real-time camera system that would also provide a low-light-level camera system. This camera system would have a 2.1x-4.2x magnification with a field of view of approximately 30 to 100 degrees. Camera tubes that are currently covered in the enclosed areas are being considered ready for advanced development. Work should be of the order of \$2,000,000.
- 3) The introduction of photo-type camera with an image intensifier to manufacturing technology. Large quantities of camera tubes for government or commercial purposes will be required to convert current laboratory technology to the state-of-the-art capabilities required for subsystems applications.
- 4) A read image photo-type camera and an optical camera system are two advanced development projects that are currently being developed. These cameras are considered ready for advanced development. Work should be of the order of \$2,000,000 and \$2,000,000.

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Table 11.3. Performance on Individual Subtests

Order No.	Order Date	Order Qty	Order Price	Order Total	Order Status
1001	10/1/77	100	1.00	100.00	Shipped
1002	10/2/77	200	2.00	200.00	Shipped
1003	10/3/77	300	3.00	300.00	Shipped
1004	10/4/77	400	4.00	400.00	Shipped
1005	10/5/77	500	5.00	500.00	Shipped
1006	10/6/77	600	6.00	600.00	Shipped
1007	10/7/77	700	7.00	700.00	Shipped
1008	10/8/77	800	8.00	800.00	Shipped
1009	10/9/77	900	9.00	900.00	Shipped
1010	10/10/77	1000	10.00	1000.00	Shipped
1011	10/11/77	1100	11.00	1100.00	Shipped
1012	10/12/77	1200	12.00	1200.00	Shipped
1013	10/13/77	1300	13.00	1300.00	Shipped
1014	10/14/77	1400	14.00	1400.00	Shipped
1015	10/15/77	1500	15.00	1500.00	Shipped
1016	10/16/77	1600	16.00	1600.00	Shipped
1017	10/17/77	1700	17.00	1700.00	Shipped
1018	10/18/77	1800	18.00	1800.00	Shipped
1019	10/19/77	1900	19.00	1900.00	Shipped
1020	10/20/77	2000	20.00	2000.00	Shipped

12. The detector was normalized to unit detector area, and the α and β components of the activities of 18 nonactive nucleotides were determined by the method made with the black body radiators at 500°K and 300°K, respectively, to the unity.

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II-23

TABLE II-46. IR Image Tubes

Tube Type	Sensitized Layer Type	Approximate Spectral Response (microns)	Operating Temperature (°C)
IR Empire Tube	Empire-type	0.7-2.0	700 (ambient)
IR Empire Tube	Empire-type	0.7-2.2	500 (ambient)
IR Empire Tube	Empire-type	0.7-2.2	300 (ambient)
IR Empire Tube	Empire-type	0.7-2.2	200 (ambient)
IR Empire Tube	Empire-type	0.7-2.2	100 (ambient)
IR Empire Tube	Empire-type	0.7-2.2	50 (ambient)

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(2) Thermoelectric Cooling - Thermoelectric cooling devices have been used to cool electronic components in space. They are solid-state devices which convert electrical energy into a cooling effect. They are used to obtain low temperatures in space.

(3) Thermoelectric Cooling - Cooling devices based on the thermoelectric effect (Peltier) convert electrical energy into a cooling effect. They are used to obtain low temperatures in space. They are solid-state devices which convert electrical energy into a cooling effect. They are used to obtain low temperatures in space.

(4) Radiation Cooling - Radiators may be used to cool electronic components in space. They are used to obtain low temperatures in space. They are used to obtain low temperatures in space.

(5) Solid Cooling - A type of cooling system is the solid-state contact system. This system uses the contact between two materials to produce a cooling effect. It has been shown that a 30-to-40 system weight ratio of cooling for one year can be obtained using solid-state contact. A hydrogen system could provide a similar heat sink for a system weight of about 10 to 15. Efforts are being made to develop a 90% efficient system for cooling. This technique has been of interest in the development of space work but so far has not been programmed for manned aerospace systems.

(6) Closed Cycle Cooling - Various closed-cycle systems have been tested. A low-capacity (0.5-hp) cooling system utilizing several stages has achieved a temperature of 200°K. However, the present design does not have sufficient cooling capability for use on future or existing detector arrays, where 1.5 to 5.0 hp would be needed. Two other such devices have been built and successfully used for cooling electronic elements in airborne operation. These provide 20°K temperatures in approximately ten minutes. One of these devices is being developed for the U.S.

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3. Window Materials

The following materials are suitable for use in the windows of the Reconnaissance VI and the AN/MAS-5. These materials are by Ewing's Radiant Energy (Infrared) Division, 1000 North 10th Street, Minneapolis, Minnesota 55403. These materials are suitable for use in the windows of the Reconnaissance VI and the AN/MAS-5.

- (1) **Hydrogen Fluoride (HF)** - This material is a colorless, odorless gas and will transmit radiation from 1 to 100 microns.
- (2) **Hydrogen Chloride (HCl)** - This material is a colorless, odorless gas and will transmit radiation from 1 to 100 microns. The refractive index (n) of HCl is 1.000000 at 15 microns. The refractive index (n) of HCl is 1.000000 at 15 microns. The refractive index (n) of HCl is 1.000000 at 15 microns. The refractive index (n) of HCl is 1.000000 at 15 microns.
- (3) **Gallium Arsenide (GaAs)** - This material is a semiconductor and will transmit radiation from 1 to 100 microns. The refractive index (n) of GaAs is 3.4 at 15 microns. The refractive index (n) of GaAs is 3.4 at 15 microns. The refractive index (n) of GaAs is 3.4 at 15 microns. The refractive index (n) of GaAs is 3.4 at 15 microns.
- (4) **Other Materials** - A number of other materials are available for use in the windows of the Reconnaissance VI and the AN/MAS-5. These materials are by Ewing's Radiant Energy (Infrared) Division, 1000 North 10th Street, Minneapolis, Minnesota 55403. These materials are suitable for use in the windows of the Reconnaissance VI and the AN/MAS-5.

d. IR Reconnaissance Systems

The Reconnaissance VI and the AN/MAS-5 are two IR reconnaissance systems that will meet tactical requirements to a limited extent. These systems have a resolution of about 2 to 3 mrad with a thermal resolution of about 0.3°C operating at a 1/4 or 1 to 1/2 rad/sec.

High-speed/low-altitude IR reconnaissance systems also have a resolution of 1.0 mrad with a thermal resolution of about 0.3°C over a field of view of 10 degrees at a 1/4 or 1 to 1/2 rad/sec.

Very-high-altitude/low-speed IR reconnaissance systems which provide an angular resolution of 0.5 mrad with a thermal resolution of about 0.3°C also are available. No suitable window material is available for

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Conclusions:

... techniques for ... of the ...
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Trends

Detections

Solid-state techniques should make possible ...
arrays of 200 sensitive elements/cm by 1965. ...
make mosaic arrays having 10,000 elements ...
available by 1970. Also, experimental efforts ...
carriers and semi-conducting materials ...
are likely to become available by 1961/1970.

The trend in IR image tubes is toward more ...
permit them to operate at higher temperatures. ...
temperatures will converge on about 1300K, where ...
may be employed. Similarly, the tube temperature environment ...
in the direction of ambient. Electrostatic ...
lighter-weight tubes which use less power and are better suited for ...
boine use, and low noise amplification will be ...
scanning electron beam has been ...
current gains of from 1000 to 2000 will be achieved.

The capability of achieving detection of temperature differences as
low as 0.3°C with a resolution of 5 $\mu\text{m}/\text{mm}$ with a uniform sensitive layer
should be achieved by 1975. This will include extension of the long-
wavelength capability to peak the sensitivity at wavelengths of 12 to 13
microns.

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Windows

Large numbers of us are to be in the area from 20 to 22, and the
for the and when the time comes, the time will be 20 to 22, and the
mission will be to 20 million could be available in the 20 to 22, and the

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UV Techniques

Ultra-thin techniques will be employed and probably will be applied to subsystems operating in space or over short air paths. IV systems based on micro tubes and phototubes seem to offer the best possibilities for an ultra-thin. UV optical components will be developed for improved imaging and filtering. Lasers operating in the UV region are a challenge possibility.

Problems

Problem areas in IR/DV technology: Intellect

- 1) Application of spin-coating technique as the alternative to con-
vide satisfactory linear arrays and monolayers.
- 2) Stable uniform photosensitive layers such as sensitive recording
techniques for imaging tubes.

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Figure 11-9. Approximate Resolution of Arc Minutes, Integrated Subsystems

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- 3) Available in literature.
- 4) Increased cooling capacity of 100% or more for 10 minutes or more.
- 5) Improved reliability of microelectronic components and systems under long-term mission conditions and at elevated or reduced environmental conditions.
- 6) Techniques for sub-system analysis and synthesis to optimize hardware for desired performance.
- 7) Techniques for prediction of system reliability.

Business

Exploratory Development

- 1) Although a lot of the sensitive elements are covered, the limits of sensitivity, the range of the frequency band for which detectors can be applied has not been reached. Detectors developed should include:
 - a) Small device having desired frequency response, low noise, and high power levels in area of 0.1 to 0.1 mW or more.
 - b) Low noise, linear, easily reconfigurable devices having output state programmable shift in lateral part of the sensitive element (back to back).
 - c) CW running and low magnetic noise on superconducting detectors at liquid helium temperatures.
- 2) Window and lens materials compatible with environmental environments must be developed in sizes up to at least 15 in. diam. These materials must also have a wide range of transmission capability ranging between 1 to 20 microns in width band to either required physical characteristics such as capability to withstand intense heat or low temperatures, have in steady state or shocked conditions.

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1) A very rough estimate by Subsystem No. 70119 is that the capital cost for all development from 1968 to 1975 would be \$100 million. Although this subsystem would be almost completed by 1975, it would incorporate techniques similar to those being developed. An average personnel of 100 would be required. The difference between O-19 and O-24C is reduced. Development cost would be on the order of \$500,000.

3) A program should be initiated to provide a compact reliable closed-cycle 5-w. capacity cooling system with capability to reach and maintain sub-boiling temperatures of 25 to 30°K and of 4.2°K.

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have been largely action and date in 1910-11 in the future
abolished and the call for in 1910-11 in the future

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In the 1967 time period recording of a target with the 200 m. 5000 ft. ground resolution was made at 150 m. alt. Although ground resolution would be demonstrated, the ground processing of the signal would probably be required.

By approximately 1970 it is expected that 5- to 10-ft ground resolutions will have been proved feasible at ranges of 100 to 300 miles. The most aerodynamic vehicles obtained values of ranges over 300 miles and may be in doubt because of the shallow depression angle at which targets would be viewed and the resultant shadowing. At orbital altitudes the aspect angles are more favorable and larger antennas can be used. Although larger antennas are desirable to obtain one beam resolution for 100 ft, they also can introduce an undesirable characteristic. To obtain one resolution in long synthetic arrays, it is necessary to accomplish beam focusing, but this can be accomplished only up to the point where the resolution is one-half of the beam antenna length. This limit may be reduced by dividing the antenna aperture into smaller segments and then processing the signal. However, this technique has not been fully investigated nor has its feasibility been proved.

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Figure II-10. High-Resolution Radar Technology Trends

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With the above limitations, the resolution of the system is limited by the number of elements in the array. The resolution of the system is limited by the number of elements in the array. The resolution of the system is limited by the number of elements in the array.

At shorter ranges, these resolutions can be improved. At 1000 ft, resolution of 5 to 10 ft may prove feasible. At ranges of 5 to 10 ft, resolution of between 1 and 2 ft may be possible. At 1000 ft, resolution of 5 to 10 ft may prove feasible. At ranges of 5 to 10 ft, resolution of between 1 and 2 ft may be possible.

3. Airborne Moving Target Location

The need for an airborne target location capability is obvious. The need for an airborne target location capability is obvious. The need for an airborne target location capability is obvious.

3. Problems

The operational basis of radar employing synthetic aperture is that the vehicle is flying along a straight line course, or along a predictable path. In the case of the aircraft, the course is along a predictable path. In the case of the aircraft, the course is along a predictable path. In the case of the aircraft, the course is along a predictable path.

Positional accuracy of the detection and target location is affected by several factors. For instance, when the vehicle is assumed to be traveling a straight path but the course deviates at a rate which is well below the build-up period (the time required to complete the synthetic aperture) for the synthetic aperture, a relative azimuth shift is observed. The percentage of azimuth shift as a function of range is approximately equal to the ratio of the uncorrected velocity component normal to the assumed straight path and the velocity along the assumed straight path.

from the existing data, which is a major problem. The existing data is not only incomplete but also of varying quality. The existing data is not only incomplete but also of varying quality. The existing data is not only incomplete but also of varying quality.

The development of processor and a higher resolution radar is a major problem area. To achieve this, a new radar, the processor, and a separate air energy that is collected in the existing radar are required. The existing radar is not only incomplete but also of varying quality. The existing data is not only incomplete but also of varying quality. The existing data is not only incomplete but also of varying quality.

Proposals

Exploration Development

- 1) Charge Detection - Recent advances in the resolution capabilities of electronic radar equipment have created interest in investigating the capabilities of radar sets to detect target changes on the ground. This problem has been noted on map-making techniques for ground targets. With this effort as a background, a new program has been initiated and emphasis on the long-term moving target detection problem. This may be available in high resolution radar. This program is to include laboratory and experimental investigations and analysis for better signal correlation of charge detection. However, the present program does not place enough emphasis on this area, which is considered to merit a more significant effort.
- 2) Special Processing - Present in-flight optical correlators are large and bulky. Development is required to exploit the potential of electronic and optical processors and of hybrid combinations of these techniques. The present program does not place adequate effort on this technology.
- 3) Side-Looking Radar - Further improvement of side-looking radars will require additional significant development in several problem areas. In connection with motion compensation, new approaches are required to ease the stringent requirements on inertial devices. Approaches to obtain auto-rotation of the synthetic array with perturbed target points would contribute

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(b) The program should be designed to provide a continuous flow of information to the command and control system, and to the intelligence community, and to the defense community.

9. Advanced Development

The SOYA program includes development of defense and intelligence systems, but does not include development of high technology systems devices to operate and construction with the command and control system. The SOYA program should be considered as a development program for the development of processed information.

The SOYA development program should be extended beyond the current development data. The current development data should be extended to include technology in change detection, with high accuracy of change, and error. This will form a base for advanced development. The current 1965 funding should be increased by approximately 10 percent, which is equivalent to about \$1,500,000 for the 1965/1966 time period.

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Scanned-Beam (SMB) Sensors

(1) Smb's

(a) Passive

VHF

1-Beam Array
28-4 ft Parabolic Reflector
16-4 ft Parabolic

35 db (10-100 MHz)
30 db (50-100 MHz)
15 db (10-500 MHz)

UHF

50-60 ft Parabolic Reflector
Corner Reflector

10-20 db (10-100 MHz)
5 db (10-500 MHz)

SHF

1-4 ft Parabolic Reflector
6-8 ft Parabolic Reflector
Horn Reflector

15 db (10-100 MHz)
35 db (10-100 MHz)
20 db (10-100 MHz)

(b) Scanning/Tracking - Many modernized SMB's are being used for 360-deg coverage. Positioning, etc. units, and tracking systems are used. Some of the most often use sector scan to increase probability of intercept. Present scan rates vary from 1 to 10 deg/sec. Maximum tracking rates are only a few deg/sec, but this is being improved for various applications.

(c) Location Accuracy

Below 50 Mc

1 percent of range

Above 50 Mc

less than 1 percent of range

(2) Receivers - Crystal, varactor, tuned radio frequency (TRF), and various superheterodyne types are being used and frequencies from 100 to 18 Gc are being covered. Below 1 Gc the general-purpose TRF receiver sensitivities are generally limited by the ambient temperature within the view of the antenna lobe. Above 1 Gc the noise floor provides the limit upon the system noise figure. Present TRF receivers have noise figures in the 6- to 9-db range. Minimum detectable signals range from -114 to -174 dbw/m².

[illegible]

(b) Antennas - For target location, it was seen necessary to locate both U/V networks and to provide the necessary antenna structure, towers and communications support for this capability. In large exercises and the antennas for ocean U/V accuracy have had a considerable limitation upon the types and characteristics of the existing antenna complex. Presently, much accuracy is being achieved 50 mi and less than a day away from the target.

VEB/MC

100-1000-100	100-1000-100	100-1000-100
100-1000-100	100-1000-100	100-1000-100

FE3

215

VOTE

5-52 616

UHF

On the 25th of January 1942
by order of the Court.

SIF

Up to 30 dB with present
entirely used capacity.

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(b) Specimens/Instruments - All specimens and instruments are marked by color
marked and labeled for color, and color is marked in the following manner:
of color, marked and labeled for color, and color is marked in the following manner:
marked and labeled for color, and color is marked in the following manner:
marked and labeled for color, and color is marked in the following manner:

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(4) Sensitivity - Receivers used for ground-based listening post duties are designed to operate within a few db of the ambient noise up to about 100 Mc and within a few db of the 1000/3000 Mc atmospheric noise at higher frequencies. At VLF, atmospheric receiver noise figures average 10 db, and at ELF, to do a VLF noise figure the contribution of atmospheric noise.

(6) Soan Rares - Much of the present, between satellites intended for being
series recognition on the emitter is a time-consuming process of re-aligning
Atmospheric voltages, tuned magnetrons and wave rectifiers on a set of the
selected bands from 200 Mc to 1000 Mc, but atmospheric receivers can receive
broadly over a range of 4 Mc to 200 Mc, and atmospheric receivers can receive
can be placed on frequency in less than 1 msec to within 100 Mc of
resonance up to 50 Mc. Such scanning rate gratification could be
highly exploited without possible changes in operational conditions.

(c) Bandwidths - Any communication channel bandwidth which is properly transmitted is susceptible to reception. VLF signals are in low and medium bandwidths and are readily decomposed by the existing receiver bandwidths. Data systems do not exceed 20 kc. One special advantage is a system in the high band looks almost innocently at a portion of the spectrum 840 kc wide.

(3) Recorders

(a) Types - Voice, data, and video magnetic tape recorders are available. Ink tape recorders for automatic Morse, facsimile, and photographic recorders are also used.

(b) Bandwidth - Photographs and magnetic-tape recorders capable of recording 4-Mc bandwidths are available today.

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(3) Recording Time - The total continuous recording time of the system is being increased to 100 hours. This will allow for the recording of 100 hours of data, which is the maximum time required for the recording of data from a single source.

(4) Display - The display is being improved to provide a more complete and accurate picture of the data. This will be achieved by the use of a more sophisticated display system, which will allow for the display of data in a more complete and accurate manner.

2. Tasks

3. General Technology Issues

Some of the major technology issues that are being addressed are: (1) the need for a more complete and accurate picture of the data; (2) the need for a more sophisticated display system; (3) the need for a more complete and accurate picture of the data; (4) the need for a more sophisticated display system.

Figure 1-1 shows the trend toward increasing the number of channels by 1975 and is based on a 100-channel system. The number of channels is being increased to 100 channels by 1975. A 10-channel system is being increased to 100 channels by 1975.

Figure 1-2 shows the trend toward increasing the number of channels by 1975 and is based on a 100-channel system. The number of channels is being increased to 100 channels by 1975. A 10-channel system is being increased to 100 channels by 1975.

Figure 1-3 shows the trend toward increasing the number of channels by 1975 and is based on a 100-channel system. The number of channels is being increased to 100 channels by 1975. A 10-channel system is being increased to 100 channels by 1975.

4. Location Accuracy

Depending on platform characteristics, the uncertainty of carrier location for airborne systems will improve from 5 to 10 percent of range over the range from 2 Mc to 40 Gc. If great concessions are made in airborne platform characteristics toward satisfying electromagnetic reconnaissance objectives, this same accuracy might be achieved down to the HF band. Accuracies of 3 to 10 percent may be possible, even in the HF band.

Use of phase measurement is being investigated for airborne location finding on a pulse-to-pulse basis. It shows promise of providing 1-day accuracy in both azimuth and elevation. Simple circuit antenna structures cover approximately octave bands. A broadband system covering 5-band is being fabricated.

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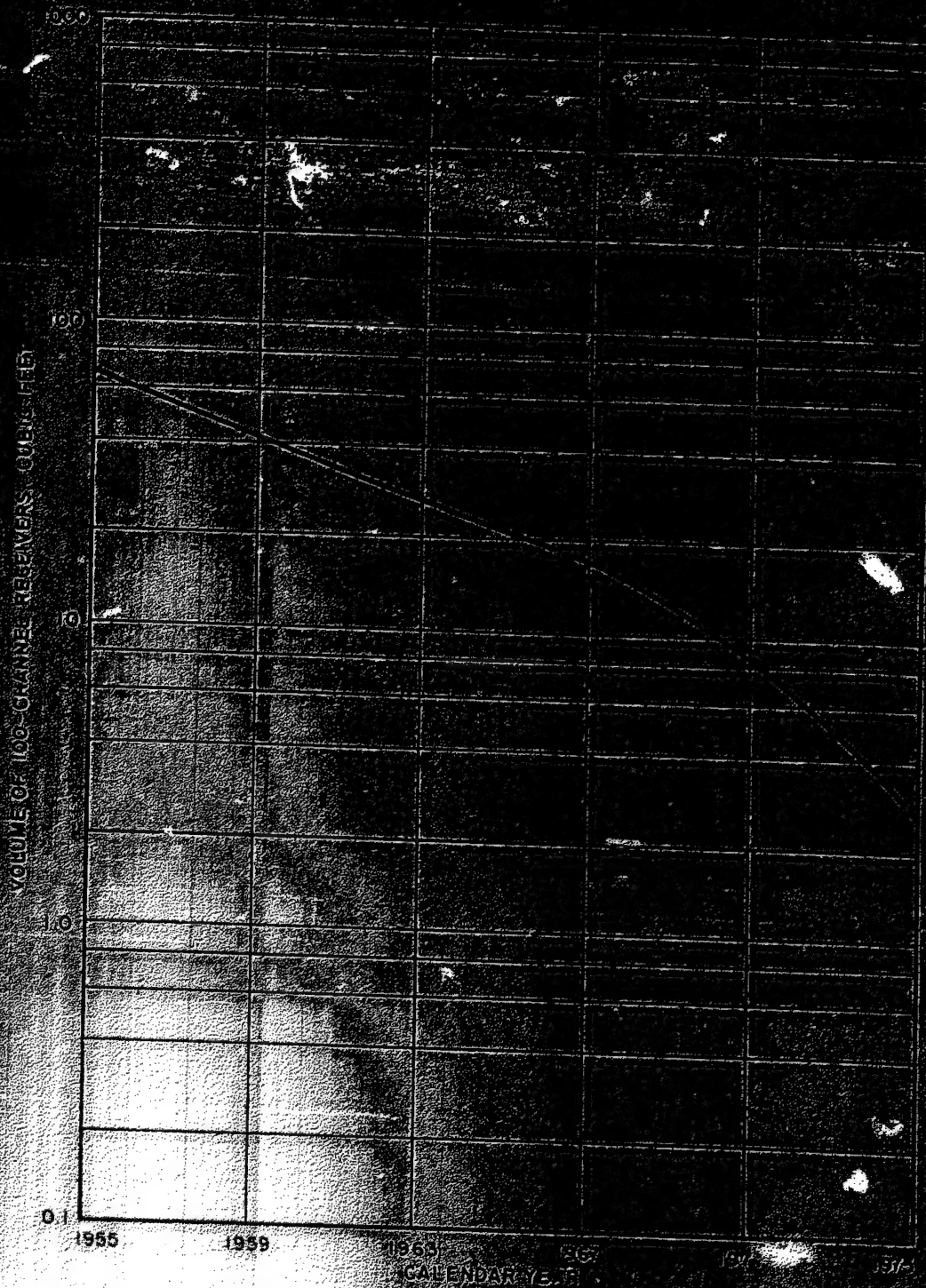


Figure II-11. Miniaturization Trends in Electronic Equipment

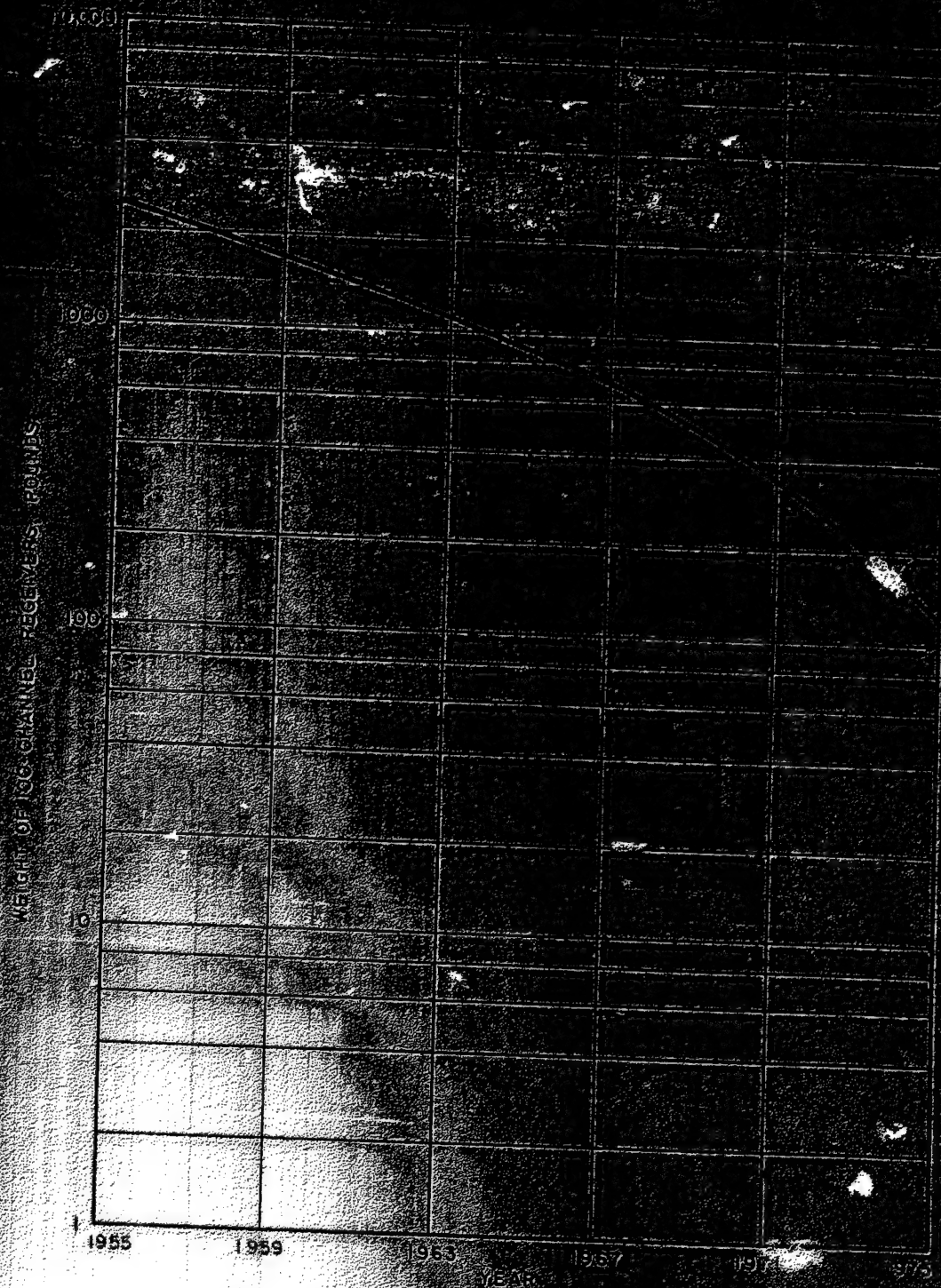


Figure II-12. Weight Trends in Electronic Equipment

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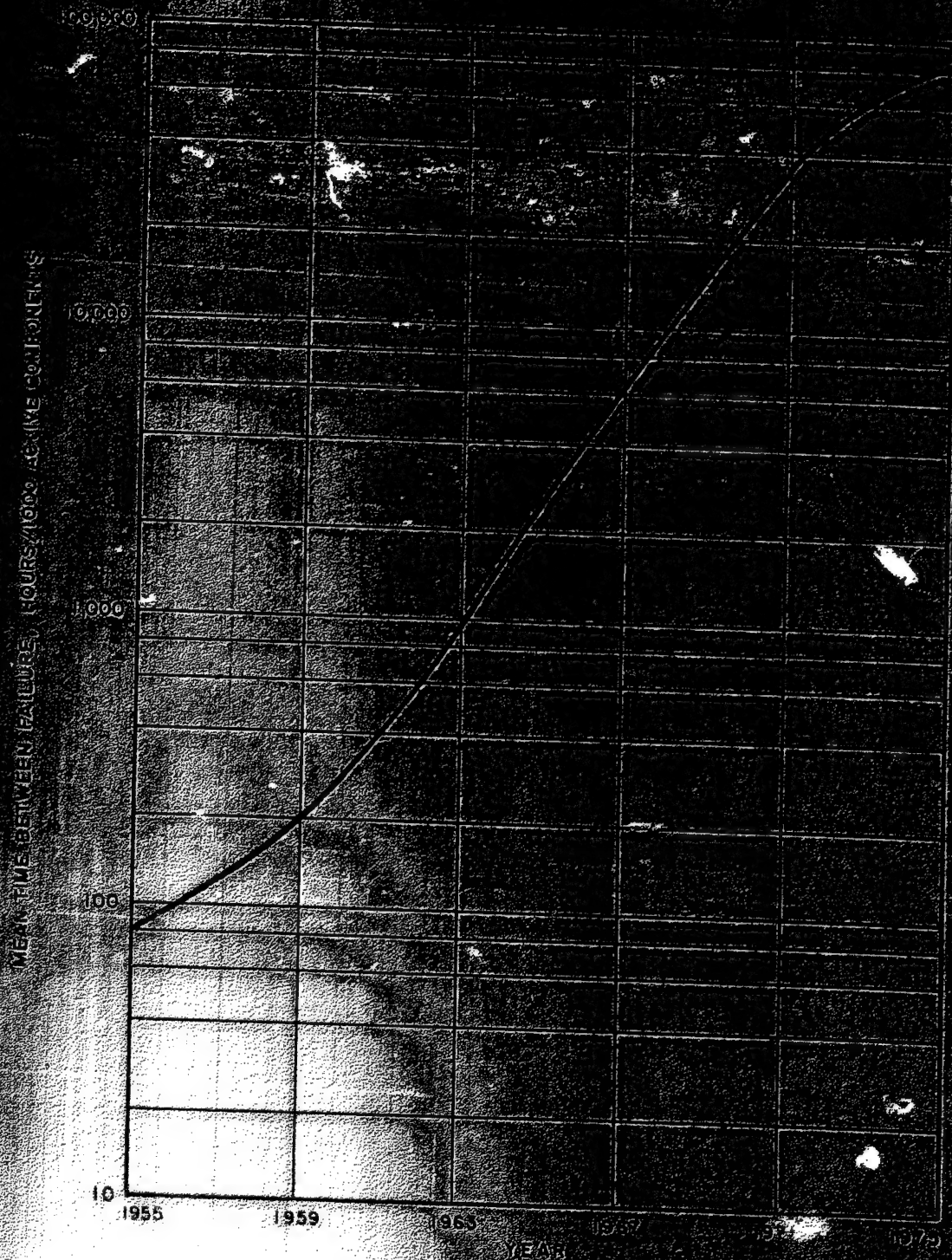


Figure II-13. Reliability Trends in Electronic Equipment

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From the 5- to 50-Mc frequency range, it is anticipated that systems will be developed which will provide the same or better performance as the systems currently available. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems.

Passive tracking can be provided with accuracy systems by using active systems. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems.

Large ground stations with large antennas and large antennas are required for the systems. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems. The systems currently available are the "active" systems, which are the "passive" systems, and the "active-passive" systems.

c. Antennas

Antennas at X-band scanning 100 deg to 100 deg have been experimentally demonstrated. Electronic scanning has been demonstrated at megawatt levels and has not found wide field application. Antennas which are required to track moving targets have usually been automatically controlled.

Integrable, tunnel, or plasma antennas, together with active and passive active/passive re-radiation devices may find application in attempts to provide improved antenna location advantages, reduction in aperture, improved efficiency, etc., for all types of microwave electronic sensor systems. In addition, adaptive techniques allowing the antenna to compensate for multipath reflections caused by the environment appear feasible today.

d. Receivers

General trends in receiver weight, space, and reliability technology should be similar to those previously described for electronic technology in general. In some portions of the spectrum, the amplifier noise figures of less than 2 db can be achieved using cryogenic techniques.

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The noise-free recording up to 10-MHz bandwidth is available in the laboratory, and would develop up to 50-MHz bandwidth and recording is anticipated shortly. A capability of 15-msec integration time and 100 dB dynamic range, noise-figure ratio (S/N), and from 3 to 100 percent duty factor and 100 to 10,000 cps will be available in the laboratory in the near future.

Elaborate soil resistance may exist due to intense hardening of surface layers
try over a 1-500' thickness. Present day resistance separation can be
peaked to be reduced to 11.5'. Soil resistance may provide the resistance
necessary to provide some/seismicity records of signal instability over very
wide bands.

As recording periods become shorter and shorter, significant levels are estimated (i.e., toward unity), recording settings required are not available, and chances of delay times and non-zero core values. Electrodeless spectroscopy has high-density storage capacity (10^6 to 10^8 channels).

The present trend is toward more automatic transfer of visually interpreted data to magnetic tape recordings. An early work is also planned for the interceptor analysis console so that the operator can enter relevant comments regarding any unusual circumstances associated with the signal or equipment. Solid-state technology promises to reduce the overall weight and volume of displays and associated control elements by a factor of 10 to 20 by 1970, and as much again by 1975. Long-term color displays with self-contained storage/regeneration capabilities are under early development or study. In one experiment, operator efficiency in discriminating between crowded signals was increased 100 to 200 percent by use of color display techniques. These are available and could be applied to intercept systems existing today.

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- 8) Development of methods and equipment for measuring the total normal and abnormal radiation intensity and power of various phenomena.
- 9) Development of methods and equipment for measuring the total normal and abnormal radiation intensity and power of various phenomena.
- 10) Application of various techniques of ultra-low-noise amplifiers to increase quality of information and reduce the quantity of information which must be received, processed, and disseminated.
- 11) Interception and processing of non-cooperative, cooperative, and incidental communications, including those of important military, scientific, and industrial significance.
- 12) Application of miniaturization techniques and devices to intercept subsystems without increasing cost or decreasing reliability.
- 13) Improved receiver line or dynamic range response from present 40-60 db range to 60-100 db.
- 14) Ultra-low-noise receiver development in frequency bands applicable to extended line-of-sight intercept.
- 15) Development of ground-intercept antenna techniques which minimize their detection by enemy forces.
- 16) Development of techniques for postdetection recording at the radio frequencies.

Emphasis

Exploratory Development

- 1) Extended-Range Coverage (Beyond Line-of-Sight) - Development of various phenomena as means for obtaining extended-range

Regal and Burke of the International Association of Agricultural Economists, in adapting techniques to the developing countries, should be vigorously pursued. It seems highly probable that agriculture is the future with require more social capital & association with the function or purpose of the planning, conducted used in the targets of interest. The position of current technology, which focuses most prominently for meeting that requirement is the area of adaptive techniques, particularly referred to as machine learning techniques, pattern recognition, and other programs and techniques. However, unless this can be accompanied and need will exist long before the research reaches a point where substantial benefits can be obtained. Long-term social capital will require a cost increase on the order of \$600,000 over the current program.

3) Extended Frequency Coverage - The frequency spectrum from 0.1 to 101.1 cps should be investigated as to whether the benefits or gains thereof that would be most likely to be used can be derived from the operational advantages that would be derived by the user in specific situations. Development of the necessary intercept techniques is indicated in order to cope with the threat most likely to be used. A 200% to 300-percent increase in effort over the present program will require additional funding on the order of \$570,000.

4) Improved Location Accuracy - Synthetic and dispersed antenna systems will be required for better airborne and land-based/inconspicuous ground-based antenna systems. The feasibility of providing distortion-free receivers to extract information which may be of specific use in the transmitter-location problem (e.g., phase information), should be investigated, such as

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 DATE: 10/10/1960

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Consolidation within the above is the full incorporation of the organizations for operations systems design and systems development. The capability within this unit for operations and systems design must be and polymorphic systems capabilities may be of great benefit for the future. However, this investigation is directed at separately from the foregoing recommendations. The following is on an additional project must be incorporated into each project. This investigation will require a 200 percent effort over the three year program, which is approximately \$150,000 to \$250,000.

7) Radiation Intelligence - Studies are needed to determine the areas most likely to be in the surveillance of international radiation. From these studies, prototype methods should be developed to identify these radiation. All non-identified, byproduct and incidental radiation from military, scientific, and industrial complexes should be considered. Some of these studies will be on the order of 1960-65.

8) **Pattern and Power Management** - The present effort is well advanced now in progress under Project 1028 should be continued. Since resolution of these problems is critical to development of generation aids and tactics, the work on this program should continue to be funded at a rate which will assure good utilization can be realized. The present funding rate is considered adequate.

9) Miniaturization - Microminiaturization and ultra-miniaturization should be pursued as a high-priority effort that is technologically applicable to receiving systems. An extensive program toward development of thin-film circuits and solid-state techniques, as applied to intercept equipments will make the most of these

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Technical and computerized data processing techniques for on-line and off-line identification, location, and/or characterization should be developed, using any number of available computers and sensors other than for processing all types of magnetic sensor data should be developed. It is envisioned that adaptive and other advanced processing techniques such as pattern recognition will be required to learn, determine, and to identify and store in cases where any of the commonly considered parameters vary randomly or over complex patterns.

Advanced Development

- 1) Airborne On-line Data Processing - Airborne data processing techniques for on-line and off-line identification, location, and/or characterization should be developed, using any number of available computers and sensors other than for processing all types of magnetic sensor data should be developed. It is envisioned that adaptive and other advanced processing techniques such as pattern recognition will be required to learn, determine, and to identify and store in cases where any of the commonly considered parameters vary randomly or over complex patterns.

General-purpose high-speed computers having an inherent flexibility to respond to changes in system environment when needed. Economy and small size as well as maintainability between air and ground mobile versions should be especially emphasized. This category is related with respect to initial effort, system and project cost, maintainability, development, and cost on the order of \$3,500,000 spread over a three- or four-year period.

- 2) Improved Location - Extremely high-precision, inertial, and/or applied antenna/loop/reflector systems are needed for the ground-based component. Airborne configurations require a passive tracking capability to accuracies less than 0.5 m in both azimuth and elevation. Desired range, velocity and acceleration information may be derived from simpler measurements. The frequency range of primary interest for this purpose is between 2000 and 3000 Mc. Propagation modes may be feasible are phased arrays and monopoles, but an alternative safety should be made of all possible antenna techniques. It is envisaged that gyro-stabilized antennas will be required. This program will cost on the order of \$3,000,000 spread over three years.

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- 5) Measurement of Rubber Order Parameters. Verifying the ability of determining the conformational distribution of the polymer chain in the crystalline phase by using the order parameter. This needs to be verified for a range of such samples, using different compounds and possibly increasing the resolution of the NMR spectra which is required. This study contains valuable general points on the order of 117,000 per the second calendar year from 1960-1961.

- 6) Age-Dependable Income-Support - Development of financially sound and soundly conducted income-support programs for elderly individuals who are unemployed is recommended. Some unemployment and income support programs should be accelerated. This study will cost about \$1.5 million for 1980-1981.

- (7) Extended Range - As soon as the results of investigations of extended-range commodities indicate areas of substantial payment in specific collection problem areas, development to provide immediate exploitation should be indicated. Cases with a value of the order of \$1,500,000 should be indicated. Cases with a value of the order of \$1,500,000 should be indicated.

- 8) Adaptive Techniques - Development and evaluation on adaptive techniques are needed to improve emitter location accuracy and to increase signal identification accuracy. Costs will be on the order of \$750,000 spread out over three years.

DATA TRANSMISSION

1. Introduction

1.1 Purpose of this Report

The following summary of data transmission capabilities is based on information available to the Defense Communications Agency (DCA) as of 10/1/68. It is not intended to be a comprehensive survey of the state of the art, but rather a summary of the current state of the art as known to the DCA.

1.2 Development Programs Now in Progress

- 1) **Regional Waste** - A military communications satellite system is being tested using the Transit satellite. The first stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68. The second stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68. The third stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68.
- 2) **High - Frequency** - Experiments have been conducted for high frequency communications using the Transit satellite. The first stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68. The second stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68. The third stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68.
- 3) **Wideband - Ground Link** - Tests have been conducted to provide a capability for transmission of high bandwidth information from a satellite to a ground station. The first stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68. The second stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68. The third stage of the program was to establish a link between a ground station and a satellite. This link was established on 10/1/68.
- a) **Wideband - RF Link** - A wideband RF link has been developed for use in the future. This link has a bandwidth of 100 MHz and a data rate of 100 Mbps. The link has been tested over a 30-mile path for a period of two months. The results of the tests show that the link is capable of transmitting data at a rate of 100 Mbps with a bandwidth of 100 MHz. The link has been tested over a 30-mile path for a period of two months. The results of the tests show that the link is capable of transmitting data at a rate of 100 Mbps with a bandwidth of 100 MHz.

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- ### III

- 6) Secure Voice Data Link - A secure voice data link will provide a secure voice data link between the aircraft and the ground station. The voice data link will be implemented in a VHF/UHF frequency. The system will provide a 100-wpm rate and a secure capability.
- 7) 4831-MHz Secure Communication System - The 4831-MHz communication system is a secure communication system which provides a secure voice data link between the aircraft and the ground station. The system will provide a 100-wpm rate and a secure capability.

2. Results

The above results are the results of the research and development work for the development of a secure voice data link between the aircraft and the ground station. The results show that the system is capable of providing a secure voice data link between the aircraft and the ground station. The system is capable of providing a 100-wpm rate and a secure capability.

3. Problems

A. Wideband Data Transmission

- 1) Propagation Media - The limitations set by the propagation media may require multiplexing of the data stream.
- 2) Synchronization - The high data rates place stringent requirements on data transmission timing synchronization. Further problems are line and frame synchronization. At some point in the system timing accuracies of one microsecond will be required.
- 3) Aircraft Antenna Design - Transmission of wideband data from an aircraft requires a tracking capability of line-of-sight stations or satellites. Acquisition of data is possible in aircraft antenna and a ground antenna is an antenna. A solution to this problem is anticipated in the near future.

- (4) Some systems have a narrow bandwidth system and the other has a wide bandwidth system. This is a problem for the system that has a narrow bandwidth system. The system that has a wide bandwidth system will be able to handle the narrow bandwidth system.
- (5) The narrow bandwidth system will be able to handle the wide bandwidth system. The system that has a wide bandwidth system will be able to handle the narrow bandwidth system.

b. Secure Voice Communications

Secure voice communications require a minimum bit rate of 14,400 to 19,200 bps. The transmission of these bits must occur over a wide bandwidth system. It will not be possible to have a narrow bandwidth system. The system that has a wide bandwidth system will be able to handle the narrow bandwidth system. The system that has a narrow bandwidth system will be able to handle the wide bandwidth system.

c. Operational Incompatibility

In many operations interference caused by friendly equipment and hostile communications. A multi-sensor aircraft will require a wideband system. Reference and radiation analysis, including data processing, storage, and communications, are needed.

d. Electro-Optical Converter

Electro-optical converters to utilize the wideband transmission systems now being tested are not available.

e. Antenna Stabilization

Antenna or antenna-pattern stabilization will be required for wideband air-to-ground data links.

f. Cryptographic Security

Cryptographic security for air-to-ground missions requires more costly equipment. Subminiaturization techniques must be developed. Synchronization techniques are time-consuming and difficult to accomplish in a jamming environment. New synchronization and anti-jamming techniques should be studied and developed.

3. General Remarks

One of the most critical areas of research in the field of information transmission is the development of a system which can be used to transmit information in a reliable manner.

The following are some of the factors which must be considered in the design of such a system:

(1) Information Transmission - The transmission of information from an information source to a destination is a process which is subject to many factors. The most important of these are the reliability of the transmission medium, the speed of the transmission, and the security of the transmission. The reliability of the transmission medium is a function of the physical properties of the medium and the nature of the transmission process. The speed of the transmission is a function of the physical properties of the medium and the nature of the transmission process. The security of the transmission is a function of the physical properties of the medium and the nature of the transmission process. Also, this type of system has limited applications in that it is not suitable for the transmission of large amounts of information, or for the transmission of information which is subject to change.

In view of the above, it is evident that the transmission of information from an information source to a destination is a process which is subject to many factors. The most important of these are the reliability of the transmission medium, the speed of the transmission, and the security of the transmission. The reliability of the transmission medium is a function of the physical properties of the medium and the nature of the transmission process. The speed of the transmission is a function of the physical properties of the medium and the nature of the transmission process. The security of the transmission is a function of the physical properties of the medium and the nature of the transmission process. Also, this type of system has limited applications in that it is not suitable for the transmission of large amounts of information, or for the transmission of information which is subject to change.

The number of photographic picture elements in a picture of resolution of 1 lp/mm can be determined by

$$Q = \left[\frac{2}{\text{mm}} \times \frac{25.4 \text{ mm}}{\text{in.}} \right]^2 = 2560 \text{ picture elements (in.)}$$

It should be noted that for transmission of information it is necessary to scan each picture element approximately twice. General formulas and definitions applicable to information transmission are:

- A Area (in.²)
- R Limiting resolution (lp/mm)

- Number of scanning channels required (10)
- Number of relay stations (10)
- Number of relay stations (10)

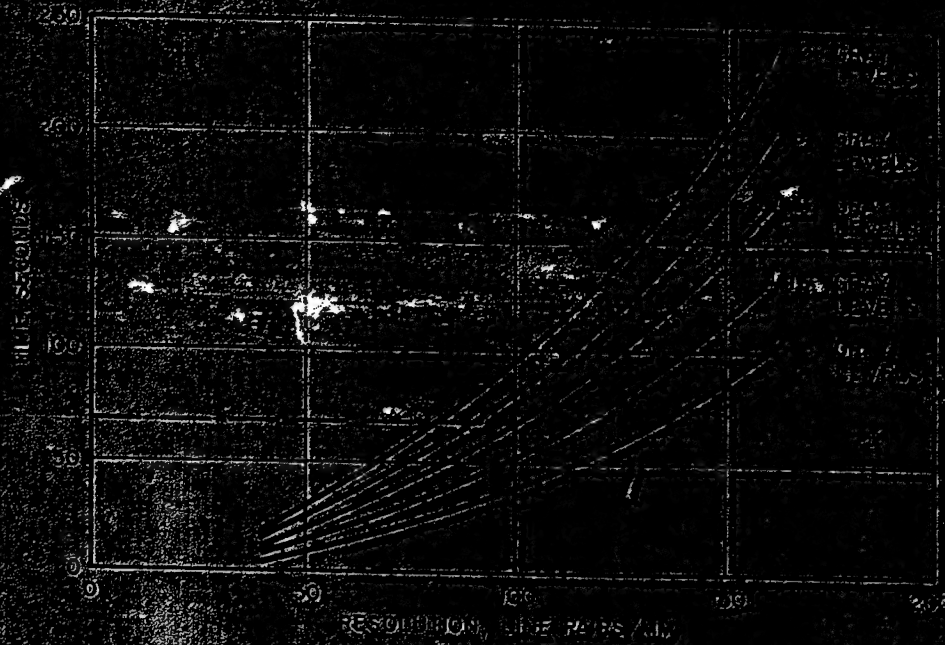
Techniques are being investigated to reduce the number of relay stations required by either increasing the number of channels or by reducing the number of relay stations required.

(2) Transmitted Time - Before digital transmission can be used it is necessary to determine the digital signal rate of transmission. The digital signal rate is determined by the video signal rate. The video signal rate is determined by the number of lines per frame (100) for 30 frames per second, which results in a 3000-line video signal rate. Based on this relationship, the transmission rate for the digital signal is equal. However, the method of digital transmission can provide only a 3000-megabit signaling rate, which is equivalent to a 12.5-Mc video band plan under the above assumptions.

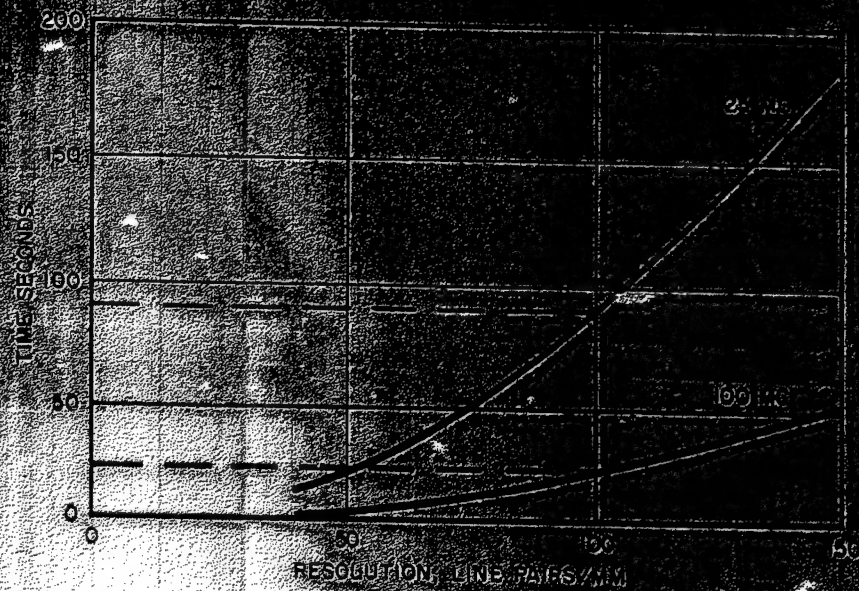
Figure 11-1(a) shows the time required to transmit one 9 x 9 inch photograph at a 300-megabit/sec signaling rate. These values are derived from Equation (33). As a typical example, the time required to transmit a 9 x 9 inch photograph at 100 Mc and 300 Mc respectively is 11 and 10 sec respectively.

Figure 11-1(b) shows the time required for analog transmission of one 9 x 9 inch photograph at a baseband video of 25 Mc/sec. At 100 Mc/sec, a typical example shows that the transmission of 100 Mc/sec, 25 and 100 Mc are required for 25 and 100 Mc respectively.

Digital transmission requires a complex encoder that introduces further expense with attendant degradation into the system, which is a major disadvantage. A second disadvantage is the extremely wide transmission bandwidth required. Analog transmission in the form of wideband TV (WBTV) is recommended, which requires operation at a lower carrier/channel ratio at a modest increase in RF bandwidth. For example, the 3000-megabit signaling rate requires a 3000-Mc RF bandwidth, while the equivalent 100-Mc video using WBTV transmission requires approximately 200 Mc. The receiving signal threshold is approximately equivalent for both modes. The present advantages of digital transmission are that true video energy can now be accomplished only with a digital pulse stream and that digital transmission is preferred when a generation of signals is desired for a large number of relays.



(a) Digital Transmission



(b) Analog Transmission

Figure II-14. Time Required to Transmit One 9" x 9" Image at a Transmission Rate of 100 Megabits/sec

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2. Polymerization of Ethylacrylate

- Director's Rights Mailbox Transcription. While Americans are represented in the present program to provide accurate background information, although present geographical base are considered sufficient for the run-to-ground phase, a full package should be furnished to permit study of the effects of production on data to permit valid analysis. This package should be designed to include "dry-land" with a future oriented variable. Increased emphasis should be placed on development of techniques to utilize the number of bins that are required to transmit nature or photo-captured information.

For COIN or limited-war applications, techniques should be investigated to provide light-weight, tracking antennas, receivers, and data-processing equipment for the proposed systems.

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$$165 = 15^2 - 5^2 = 5(10) = 5(2 \cdot 5) = 5^2 \cdot 2$$

- [illegible]

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國語

DATA PROCESSING

a. Silver-Halide Systems

Photo reproduction systems are used to produce copies of documents, maps, and other information. These systems are used in a variety of applications, including the production of master positives, contact prints, and enlargements. The systems are characterized by their ability to produce high-quality copies of documents and maps. The systems are used in a variety of applications, including the production of master positives, contact prints, and enlargements. The systems are characterized by their ability to produce high-quality copies of documents and maps. The systems are used in a variety of applications, including the production of master positives, contact prints, and enlargements. The systems are characterized by their ability to produce high-quality copies of documents and maps.

Except for very limited special applications, the silver-halide system has not the necessary characteristics to be used as a master positive. Current characteristics of these systems are listed in Table II-6.

b. High-Accuracy Photo Reproduction

The conventional reproduction cycle is a four-step process involving generation of the original negative, the master positive, the duplicate negative, and the duplicate positive. Reproduction quality is dependent on the quality of the original negative.

In a precisely controlled laboratory environment 450- to 200-lin/mm low-concentration imagery can be reproduced with negligible loss of information content. In gelatin silver halide systems this is accomplished by reproducing the information density by balancing the exposure during production on the master positive. Systems using glass masters can maintain this order of quality through continuous contact printing operations. However, the machines are extremely bulky, contain very high-energy light or-beam sources, and require overly complicated methods of cooling the lamps and collimating the light.

c. Photo-Processing in an Austere Environment

This type of processing capability is provided by the ES-30 portable photo laboratory to support GSR 405. This laboratory provides a highly mobile photographic capability designed for rapid deployment to worldwide locations. The laboratory can process 35-mm through 9.5-in. wide materials, contact print 5- to 9.5-in. materials, and enlarge 70-mm and 35-in. material two times (2X). The laboratory is capable of processing

Table 12-6. Recommended Reproduction Methods

Material	Sensitivity (Exposure Index)	Resolving Power (lp/mm)	Processing	Continuous Tone	Variable Contrast	Remarks/Availability
Gelatin APP	Blue/UV (10 ⁻² to 10 ⁻¹⁰)	100-250	Wet	Excellent	Yes	Low
Vacuum- Exposures APP	Blue/UV (10 ⁻² to 10 ⁻¹⁰)	400	Staining Solution	Excellent	Yes	1967/1970
Diaz	Blue/UV (10 ⁻⁵ to 10 ⁻⁷)	800-1200	Wet	Good	No	1967/1970
Photo- Resist Dye	Blue/UV (10 ⁻² to 10 ⁻¹⁰)	100-200	Wet	Good	No	1967/1970
Photo- Resist Dye	Red/UV (10 ⁻² to 10 ⁻¹⁰)	800-1000	Wet	Good	No	1967/1970

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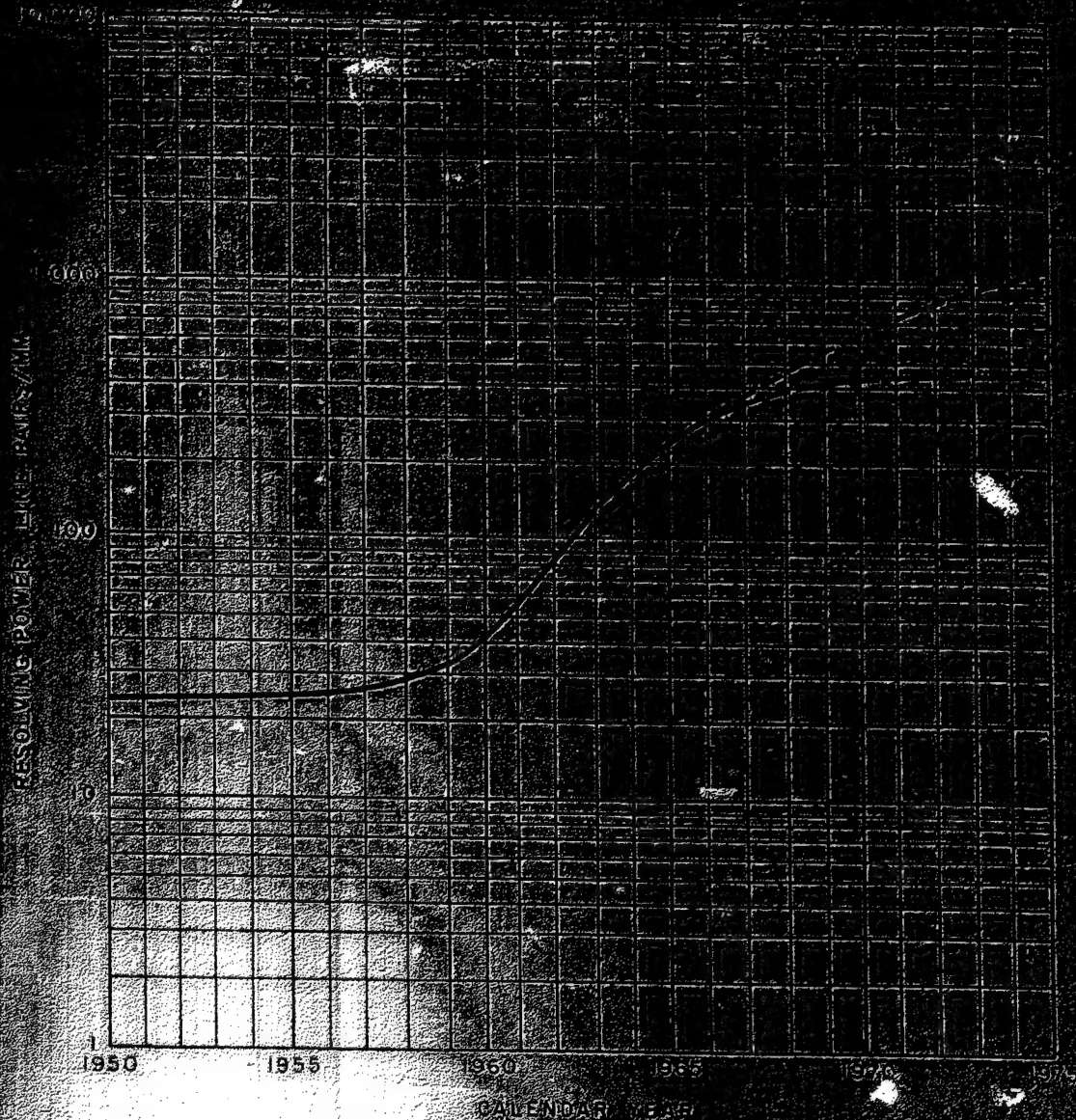


Figure II-15. Approximate Low-Contrast Resolution Threshold for Reproduction Throughout Generations of Continuous-Tone Negatives

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II-16

Processing in an Airtight Environment

During the 1970/1975 time period, significant improvements were made in the processing of microfilm, microfiche, and microdot. These improvements were made possible by the development of new processing techniques and the use of airtight processing environments. The use of airtight processing environments has been shown to be essential for the production of high quality microfilm, microfiche, and microdot. The use of airtight processing environments has also been shown to be essential for the production of high quality microfilm, microfiche, and microdot.

In-Medium Processing

During the 1965/1970 time period, significant improvements were made in the processing of microfilm, microfiche, and microdot. These improvements were made possible by the development of new processing techniques and the use of in-medium processing environments. The use of in-medium processing environments has been shown to be essential for the production of high quality microfilm, microfiche, and microdot. The use of in-medium processing environments has also been shown to be essential for the production of high quality microfilm, microfiche, and microdot.

Electronic Signal Image Recording

Electronic image recording or reconstruction can be subdivided into the elements of source or energy to which the recording material is sensitive, electrically controlled modulating devices for this energy, scanning devices, media which are sensitive to this energy, and media processing. Requirements are for increased recording resolution, increased media to data, improved image quality, and simple techniques. Advanced techniques include electron beams, laser-power light sources (lasers, plasmas, etc.), electrostatic probes or heads, photoconductive materials, and various electro-mechanical and electro-optical transducers. Media include thermoplastic deformation materials, both conventional and unconventional photo materials, and materials that are sensitive to ultraviolet and infrared heads and probes. The broad parameters of recording bandwidth is shown in Figure 11-16.

Special Photo-Processing Techniques

During the 1970/1975 time period, special photo-processing techniques were developed. These techniques include grain integration, and contrast modulation techniques. These techniques offer promise of much more discernible information for data extraction than existing techniques. Quality improvements on the order of magnitude can be expected from these techniques by 1975. By 1970 color and CB film will have been improved in speed resolution and simplicity of processing. These will be a much more useful tool, although it will not replace black and white photography.

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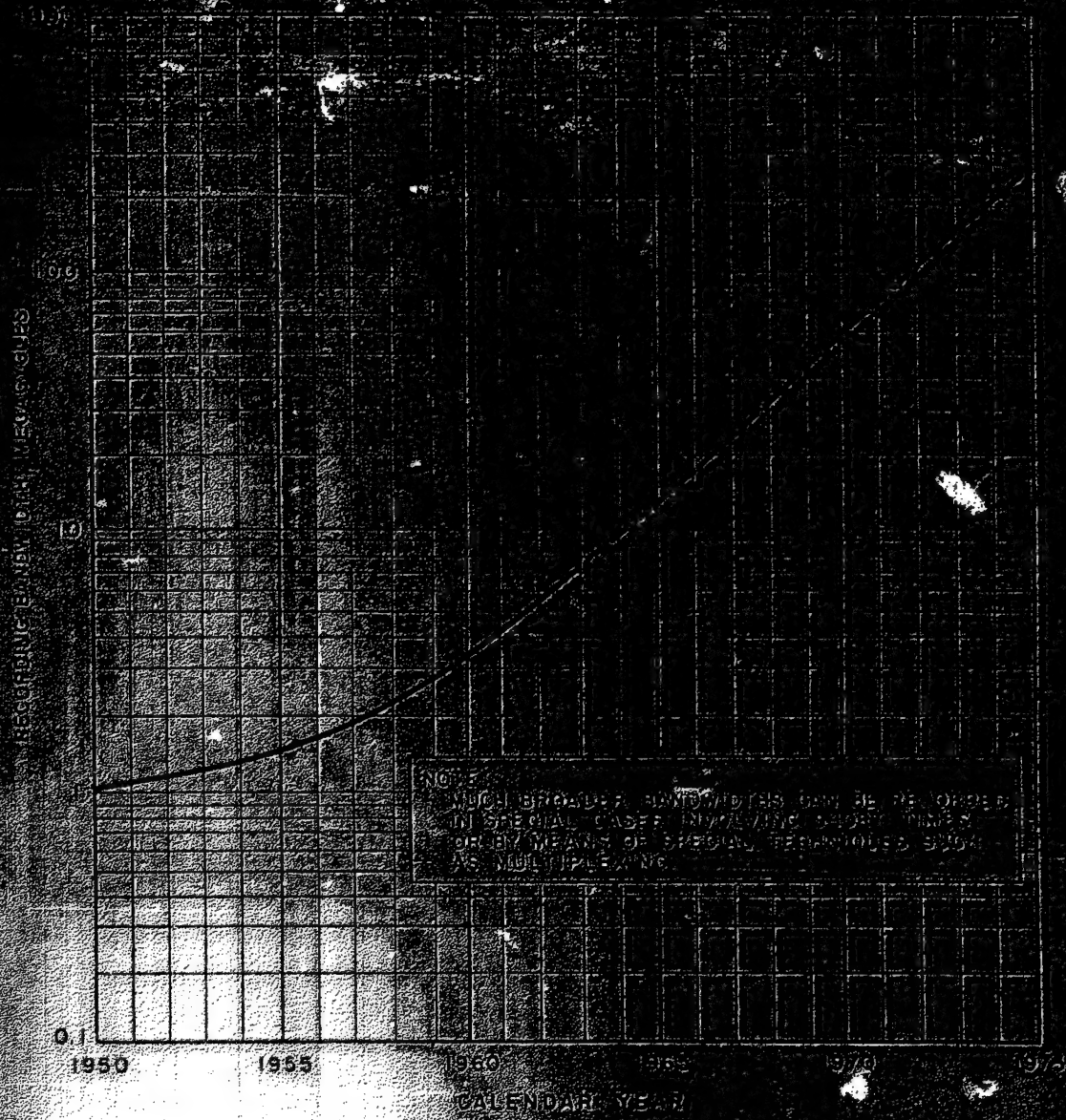


Figure II-16. Approximate Electronic Signal Bandwidth Record and Trend for Reconstructing Degraded Images.

of these 1964-1965 books began. Subsequently all of these publications have been improved and revised for many editions. However, complete up-to-date books are not available and older editions are out of date. Further, both printed and electronic information is being accumulated at a very rapid rate so that no one person can keep up with the changes. The printed books are being replaced by microfiche, microfilm, etc. and are becoming obsolete. The printed books are being replaced by microfiche, microfilm, etc. and are becoming obsolete. The printed books are being replaced by microfiche, microfilm, etc. and are becoming obsolete.

3. Problems

PHOTOGRAPHIC REPRODUCTION

Controlling game stability or loss, reducing flow of game resources, and producing homogeneous game sizes are the main problems to be solved in making a high-quality silver metal deposition material. The main problem to be solved in unconventional materials such as metals and alloys is to improve their stability, reduce their density, improve their strength, and improve the stability of the structure.

9. High-Acidity Reproduction

Precision lenses and reproduction equipment operating in an extremely clean environment and having tight tolerances for geometry and temperature will be required. Increased speed of operation and computer-aided computer-controlled reproduction operations are other areas that need investigation. More exact semiconductor techniques or possibly the transition for complete automation and for better control of manufacturing uncertainties during the reproduction cycle must be developed, as well as extremely high-energy light sources relative to the spectral sensitivity of the relatively insensitive unconventional materials.

c. Processing in Austere Environment

The major problems in this area are

- 1) Providing simple, portable environments for consolidating the processing environments.

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1) Providing means for recording data with precision and reliability, and with facilitating data processing and processing capability.

2) Providing means for the storage of data in a form which is readily accessible and which is suitable for processing and processing capability.

d. In-Flight Processing

The major problems in this area are:

- 1) Providing means for the real-time processing of data with precision and reliability, and with facilitating data processing and processing capability.
- 2) Simplifying and automating the processing, operations, and techniques.
- 3) Providing a means for processing data with maintaining quality of processing. Quality must be comparable to that obtained by conventional ground-based machine processing.
- 4) Providing a high quality dry positive that can be stored or that will be immediately available for reproduction with the negative. Quality must be equal to the film generation positive produced by conventional printing techniques. Quality of the reproducible negative must not be degraded by the technique used to provide the positive. Non-destructive processing should be considered.

e. Electronic Signal Image Recording

The major problems in this area are:

- 1) Providing energy sources and techniques which can be focused to very small points and which are suitable for modulating, scanning, and energizing media.
- 2) Providing electron beam and light source modulation techniques (0 to 100 percent modulation).
- 3) Providing electron beams of micron sizes and interacting intensities which can be modulated and deflected from 5 to 10 mm without loss of focus.

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- 7) Preserving reproduction of people and other objects of interest to remain suitable for future use.
- 8) Preserving information and scientific knowledge to maintain standard of mobile and stationary.
- 9) Preserving as much information as possible with recording equipment. These media must be stored in such a manner as to be easily accessed, retransmitted, and data and from other media and image quality characteristics. Secondary recording methods, electron spectroscopy, information quality, etc., may be obtained for these recording methods.

1. Special Processing Techniques

Problems requiring resolution are:

- 1) Understanding and controlling the effects of film processing on film contrast for effective reproduction of spectral, spatial, and color gradients. Simple quality control of color and film processing are also needed.
- 2) Investigating color reproduction and colorimetric systems for reproduction of color images.

2. Image Data Processing

Applicable problem areas are:

- 1) Two-dimensional computer programs and methods techniques to permit restoration of photographic images which have image smear and geometric distortion, and methods for volume processing of smeared and distorted images must be developed.
- 2) Computers must be greatly miniaturized and specialized.

3. Emphasis

a. Exploratory Development

- 1) Reproduction Materials - The current state of effort on reproduction materials is considered to be adequate and no shift in emphasis is recommended. No significant additional improvements in advancement of the state-of-the-art could be expected by major increases in funding resources.

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2) High Accuracy Reproduction of the color and size of original artwork reproduction for those who require color and size reproduction for their business. For those who require color and size reproduction for their business.

[illegible]

1) Image Processing - interested subjects should be placed on solving the problems of providing a suitable software, hardware, time processing, and high-quality colorizing to such image. Dry-processing techniques, optimization, computer hardware, and research and development in optical and color research should be considered.

[illegible]

6) Special Processing Techniques - Recent technology centered work on restoration of photographs, which has been highly promising. Additional efforts should be made available to improve these techniques and to develop methods for volume processing of computer signals.

Although work in the above areas is presently programmed, funds and man-power on these programs should be increased by 25 percent, which is equivalent to approximately \$750,000.

1) Reproduction Materials - Introduction of new types of structural materials will cause major problems in manufacturing technology. A major government or commercial effort will be required to

1951

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II-85

The following information was obtained from the records of the [redacted] Department of the Interior, Bureau of Land Management, regarding the [redacted] land grant.

[The remainder of the document contains extremely faint, illegible text.]

(b) Targeting and Charting
Charting from sensor data and
targeting and charting are pre-
sented and location of objects
topography in a variety of forms.

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1990

b. **SIGINT Data Extraction**

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The first of these is the fact that the data is not
completely consistent with the model. This is due to the
fact that the data is not perfectly random. There are
some systematic deviations from the model, which are
most apparent in the low frequency region. These deviations
are most likely due to the fact that the data is not
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(5) Targeting and Characterization
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Development Council has demonstrated the attainment of heavily subsidized rates is difficult to produce. It is likely to be realistic only if the rate is less than 50 percent of the rate attained by 1970.



Figure II-17. Data transmission error.

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II-17

1. The purpose of this report is to provide a summary of the work done during the past year in the field of the study of the properties of the human eye. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles.

2. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles.

3. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles.

4. SUMMARY OF RESULTS

The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles. The work has been carried out in the Department of Psychology, University of California, San Diego, and in the Department of Psychology, University of California, Los Angeles.

To improve and expedite the work, a number of changes have been made in the organization of the work. These changes include the following: (1) the work has been divided into two main parts, one dealing with the study of the properties of the human eye, and the other dealing with the study of the properties of the human ear. (2) the work has been divided into two main parts, one dealing with the study of the properties of the human eye, and the other dealing with the study of the properties of the human ear. (3) the work has been divided into two main parts, one dealing with the study of the properties of the human eye, and the other dealing with the study of the properties of the human ear.

1997-1998

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THREATS AND VULNERABILITIES

Threats and vulnerabilities are the primary factors in the assessment of risk. Threats are the potential for harm or damage to a system, while vulnerabilities are the weaknesses or flaws in a system that make it susceptible to threats.

THREATS AND VULNERABILITIES

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(b) Targeting and Characterization of Threats and Vulnerabilities are outlined above.

An accelerated program of research in digital analysis in high speed computers. Image density on a film is converted back to the spectral radiance. A highly encouraging indication of progress.

SECRET

- 1) ...
- 2) ...
- 3) Cartographic representation of sensor data.
- 4) Rapid and accurate determination of sensor data.
- 5) Rectification of sensor data.
- 6) Rapid stereo and non-stereo processing for all sensor data.
- 7) Rapid production of ...
- 8) Rapid production of ...

SECRET

1. General Description of the System

The system is designed to provide a means for the rapid and accurate determination of the position of a point on the earth's surface. It is based on the principle of triangulation, which involves the measurement of the angles between three points. The system is capable of determining the position of a point to within a few feet, and it can be used to determine the position of a point at any time of day or night. The system is also capable of determining the position of a point at any location on the earth's surface.

2. System Components

a. Observatory Development

The observatory development phase of the project involves the construction of a network of observatories. These observatories will be used to observe the positions of the stars and other celestial objects. The observatories will be located at various points on the earth's surface, and they will be equipped with telescopes and other instruments for observing the sky.

b. Star Catalogue

The star catalogue is a list of the positions of the stars and other celestial objects. It is used to determine the positions of the stars and other celestial objects at any time of day or night. The star catalogue is also used to determine the positions of the stars and other celestial objects at any location on the earth's surface.

c. Star Catalogue

The star catalogue is a list of the positions of the stars and other celestial objects. It is used to determine the positions of the stars and other celestial objects at any time of day or night. The star catalogue is also used to determine the positions of the stars and other celestial objects at any location on the earth's surface.

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e. Star Catalogue

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1) Equipment Development
The equipment development program is designed to develop and test new equipment for the purpose of improving the efficiency and effectiveness of the program. The program is divided into two main categories: equipment development and equipment testing. The equipment development category includes the design, construction, and testing of new equipment. The equipment testing category includes the evaluation of the performance of existing equipment.

2) Equipment Testing
The equipment testing program is designed to evaluate the performance of existing equipment. The program is divided into two main categories: equipment testing and equipment evaluation. The equipment testing category includes the evaluation of the performance of existing equipment. The equipment evaluation category includes the evaluation of the performance of existing equipment.

- 1) Equipment Development
The equipment development program is designed to develop and test new equipment for the purpose of improving the efficiency and effectiveness of the program. The program is divided into two main categories: equipment development and equipment testing. The equipment development category includes the design, construction, and testing of new equipment. The equipment testing category includes the evaluation of the performance of existing equipment.
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3) Equipment Evaluation
The equipment evaluation program is designed to evaluate the performance of existing equipment. The program is divided into two main categories: equipment testing and equipment evaluation. The equipment testing category includes the evaluation of the performance of existing equipment. The equipment evaluation category includes the evaluation of the performance of existing equipment.

- 2) A variety of equipment is initiated to significantly improve data production and equipment developments as carbon copy, universal storage, point devices, rectifiers, etc. Funds required are \$100,000.

1) The Commission, having received the report of the Committee on the subject of the proposed amendments to the Constitution, has decided to recommend to the President the following amendments:

2) The Commission has also decided to recommend to the President the following amendments:

3) The Commission has also decided to recommend to the President the following amendments:

4) The Commission has also decided to recommend to the President the following amendments:

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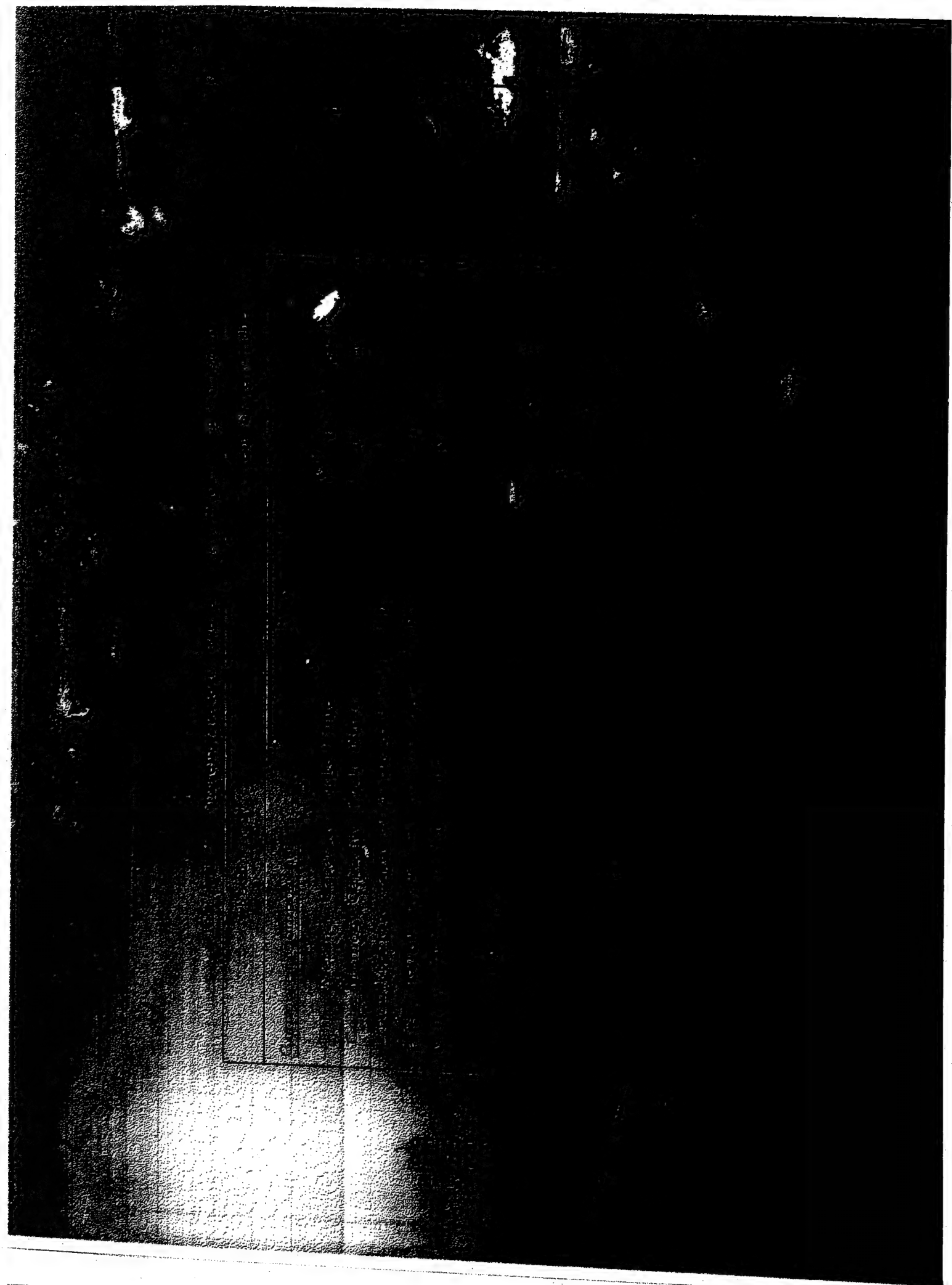
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Preparation and error correction account for the largest portion of the summing function is computer operations. A relatively small amount of querying the files or processing systems efficient utilization sized, usually at the expense of



The first step in the process of data processing is the collection of data. This is done by the user, who provides the data to the system. The system then processes the data and produces a result. The result is then used by the user to make a decision. This is the basic cycle of data processing.

The second step in the process of data processing is the storage of data. This is done by the system, which stores the data in a database. The database is then used by the user to retrieve the data when needed.

The third step in the process of data processing is the analysis of data. This is done by the system, which analyzes the data and produces a report. The report is then used by the user to make a decision. This is the basic cycle of data processing.

The fourth step in the process of data processing is the distribution of data. This is done by the system, which distributes the data to the user. The user then uses the data to make a decision.

The fifth step in the process of data processing is the evaluation of data. This is done by the system, which evaluates the data and produces a report. The report is then used by the user to make a decision.

The sixth step in the process of data processing is the maintenance of data. This is done by the system, which maintains the data and produces a report. The report is then used by the user to make a decision.

(b) Input Processing. This is the first step in the process of data processing. It involves the collection of data from the user. The data is then processed by the system and a result is produced. The result is then used by the user to make a decision. This is the basic cycle of data processing.

SECRET

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Figure II-19. Typing



Figure II-20. Data-Reduction

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II-412

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the situation.

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The Strategic Air Command (SAC) employs MINICARD, among other things, a chip system where each 16-mm film has a reduction ratio together with a high speed and expensive system includes an optical and reproducing chips.

SECRET

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SECRET

the differences in the views of the various groups. The differences are not only in the views of the various groups but also in the views of the various groups. The differences are not only in the views of the various groups but also in the views of the various groups. The differences are not only in the views of the various groups but also in the views of the various groups.

From the beginning of the project, the various groups have been working together to develop a system that will be able to handle the various groups. The system will be able to handle the various groups and will be able to handle the various groups. The system will be able to handle the various groups and will be able to handle the various groups.

As the system is developed, the various groups will be able to use the system. The system will be able to handle the various groups and will be able to handle the various groups. The system will be able to handle the various groups and will be able to handle the various groups.

When the system is developed, the various groups will be able to use the system. The system will be able to handle the various groups and will be able to handle the various groups. The system will be able to handle the various groups and will be able to handle the various groups.

The problem of the various groups is a problem that is not only in the views of the various groups but also in the views of the various groups. The problem is not only in the views of the various groups but also in the views of the various groups. The problem is not only in the views of the various groups but also in the views of the various groups.

A modest amount of experiment on the various groups has generally been done. The various groups have been working together to develop a system that will be able to handle the various groups. The various groups have been working together to develop a system that will be able to handle the various groups.

A point of some concern is increasing, "mass-memory" secondary storage devices. access to very large data central processor, in that for access to the secondary predominantly of this type processor.



Figure II-21. Comparison of storage capacity and cycle time.

SECRET

The image shows a dark, high-contrast scan of a document page, likely a ledger or form. The page is mostly black with some white highlights and faint, illegible text. A small, bright white object is visible near the top center. The page is divided into sections by faint lines, and there are some faint, illegible text elements scattered across the surface.

2) Associative memory is a type of memory in which the data is stored in a way that allows for rapid retrieval. This is achieved by using a special type of memory structure called an associative array. In this structure, the data is organized into rows and columns, and the retrieval process involves searching for a specific value in a particular row or column. This type of memory is particularly useful for applications that require fast lookups, such as database systems and certain types of artificial intelligence.

In the context of associative memory, the term "associative" refers to the ability of the memory to associate a specific input with a specific output. This is achieved by using a special type of memory structure called an associative array. In this structure, the data is organized into rows and columns, and the retrieval process involves searching for a specific value in a particular row or column. This type of memory is particularly useful for applications that require fast lookups, such as database systems and certain types of artificial intelligence.

(2) The second type of memory structure is called a "dynamic" memory structure. This type of memory structure is designed to allow for the dynamic allocation of memory space. In other words, the memory structure can grow or shrink as needed, depending on the requirements of the application. This is achieved by using a special type of memory structure called a dynamic array. In this structure, the data is organized into rows and columns, and the retrieval process involves searching for a specific value in a particular row or column. This type of memory is particularly useful for applications that require fast lookups, such as database systems and certain types of artificial intelligence.

The third type of memory structure is called a "network" memory structure. This type of memory structure is designed to allow for the dynamic allocation of memory space. In other words, the memory structure can grow or shrink as needed, depending on the requirements of the application. This is achieved by using a special type of memory structure called a dynamic array. In this structure, the data is organized into rows and columns, and the retrieval process involves searching for a specific value in a particular row or column. This type of memory is particularly useful for applications that require fast lookups, such as database systems and certain types of artificial intelligence.

Each of these memory structures has its own set of advantages and disadvantages. For example, associative memory is fast but can be expensive to implement. Dynamic memory structures are flexible but can be slow. Network memory structures are fast and flexible but can be complex to implement. The choice of which memory structure to use depends on the specific requirements of the application.

Dynamic allocation of both memory and processing techniques to the network structures is a necessity.

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 2. Organization
 3. Personnel
 4. Equipment
 5. Methods
 6. Results
 7. Conclusions
 8. References
 9. Appendices
 10. Tables
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 14. Glossary
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 16. Footnotes
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The Executive Committee
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the goal of conciseness can be achieved by using new terms to the machine. For example, instead of giving a name to some composite collection of data, one could avoid having to itemize them. Similarly, the format of reports could be defined and the machine would then generate the reports.

SECRET

One of these three systems is the "integral-index" system, which is the most common. It is a system in which the data is indexed by a unique number, and the index is stored in a separate file. This system is the most efficient, but it is also the most expensive.

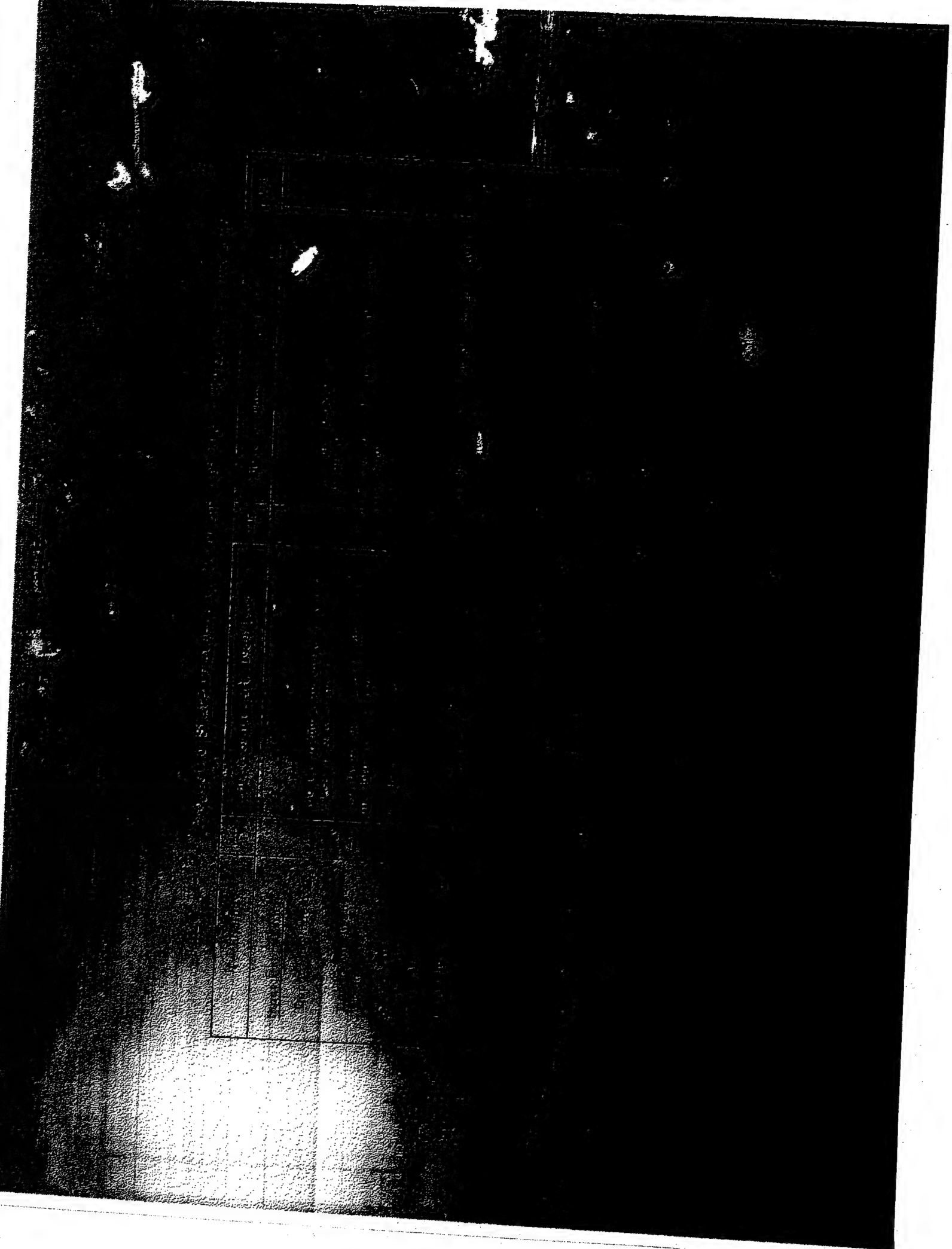
The second system is the "keyword" system, which is the least efficient. It is a system in which the data is indexed by a keyword, and the index is stored in a separate file. This system is the least efficient, but it is also the least expensive.

The third system is the "keyword-index" system, which is the most efficient. It is a system in which the data is indexed by a keyword, and the index is stored in a separate file. This system is the most efficient, but it is also the most expensive.

The "integral-index" system is the most efficient, but it is also the most expensive. It is a system in which the data is indexed by a unique number, and the index is stored in a separate file. This system is the most efficient, but it is also the most expensive.

The "keyword" system is the least efficient, but it is also the least expensive. It is a system in which the data is indexed by a keyword, and the index is stored in a separate file. This system is the least efficient, but it is also the least expensive.

The "keyword-index" system is the most efficient, but it is also the most expensive. It is a system in which the data is indexed by a keyword, and the index is stored in a separate file. This system is the most efficient, but it is also the most expensive.



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Input Processing

A major problem in the implementation of a system is the input processing. This is the point at which the data is entered into the system. It is the most critical point in the system, as it is the point at which the data is first processed. If the input is not processed correctly, the entire system will be affected. Therefore, it is essential that the input processing be done correctly. This is usually done by the support staff.

SECRET

The following information is being furnished to you for your information. It is the policy of the Department of Defense to keep you advised of the progress of the research and development efforts in the field of defense technology. The information is being furnished to you in confidence and is not to be released to the public or other personnel without the express approval of the Department of Defense. The information is being furnished to you for your information and is not to be used for any other purpose.

1. Introduction

The following information is being furnished to you for your information. It is the policy of the Department of Defense to keep you advised of the progress of the research and development efforts in the field of defense technology. The information is being furnished to you in confidence and is not to be released to the public or other personnel without the express approval of the Department of Defense. The information is being furnished to you for your information and is not to be used for any other purpose.

RESEARCH CORPORATION

1. The first of these is the fact that the United States has a large and growing population of people who are not citizens of the United States. This is a result of the large number of people who have immigrated to the United States in recent years, and the fact that many of these people are not naturalized citizens.

- 1) Improved techniques for machine translation of natural language.
- 2) Improved techniques for machine translation of natural language.
- 3) Improved techniques for machine translation of natural language.
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1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the study and the objectives of the research.

2. The second part of the report is a detailed description of the methodology used in the study. It includes information about the sample size, the data collection methods, and the statistical analysis techniques.

3. The third part of the report is a presentation of the results of the study. It includes tables, figures, and text describing the findings of the research.

4. The fourth part of the report is a discussion of the results and their implications. It includes a comparison of the findings with previous research and a discussion of the limitations of the study.

5. The fifth part of the report is a conclusion and a list of references. The conclusion summarizes the main findings of the study, and the references list the sources of information used in the research.

SECRET

SENSOR INFORMATION

Introduction

The sensor information is a key element in the intelligence gathering process. It provides the raw data from which intelligence is derived. The sensor information is collected from a variety of sources, including satellites, aircraft, ships, and ground-based sensors. The sensor information is then processed and analyzed to produce intelligence. The sensor information is a critical component of the intelligence gathering process, and it is essential to have a good understanding of it.

The sensor information is collected from a variety of sources, including satellites, aircraft, ships, and ground-based sensors. The sensor information is then processed and analyzed to produce intelligence. The sensor information is a critical component of the intelligence gathering process, and it is essential to have a good understanding of it.

Consideration is given to the various types of sensors and the information they provide. The sensor information is a critical component of the intelligence gathering process, and it is essential to have a good understanding of it.

Techniques for processing sensor information are now being explored. This includes the use of electro-optical sensors, which provide high-resolution imagery. The sensor information is then processed and analyzed to produce intelligence. The sensor information is a critical component of the intelligence gathering process, and it is essential to have a good understanding of it.

1. NAME _____
 2. DATE _____
 3. TIME _____
 4. LOCATION _____
 5. REASON _____
 6. WITNESSES _____
 7. REPORT _____
 8. SIGNATURE _____
 9. OFFICIAL _____
 10. REMARKS _____

GRAND

...the human eye ... Transmission to ... except coherent ... recording, or in ... ing or filtering ... will still require at least ... raw data and for processing ... posite displays for human ...

Problem based learning is a teaching method that emphasizes the use of problems as the vehicle for learning. It is a student-centered approach that encourages students to work together to solve a problem, rather than being taught a concept by a teacher. Problem based learning is based on the idea that students learn best when they are actively engaged in a task and are able to apply their knowledge to a real-world problem. This approach is often used in science, mathematics, and engineering courses, but it can be applied to any subject. Problem based learning has several benefits, including that it helps students develop critical thinking skills, improves their problem-solving abilities, and encourages them to work together and communicate effectively. It also helps students to see the relevance of what they are learning and to become more motivated to learn. Problem based learning is a powerful tool for teaching and learning, and it is becoming increasingly popular in schools and universities around the world.

- 1) Multisensor fusion
- 2) Near-real-time processing
- 3) Reduction of data to minimum necessary
- 4) Maximum man/machine interaction
- 5) Automation of target identification and classification

SECRET



Figure II-22. Approximate value of the variable

- 1) ...
- 2) ...
- 3) ...
- 4) ...
- 5) ...
- 6) ...

Although work in the above area is, of course, continuing, it is felt that manpower should be increased by at least 50% to \$1,000,000.

ORIGINAL SENSORS

Sensor Types

The following list of sensors is intended to provide a comprehensive overview of the various types of sensors used in the system. The list is organized into two main categories: 1) Sensors used for data collection and 2) Sensors used for data processing and analysis.

- 1) Temperature sensors
- 2) Pressure sensors
- 3) Humidity sensors
- 4) Acceleration sensors
- 5) Rotation sensors
- 6) Position sensors
- 7) Velocity sensors
- 8) Force sensors
- 9) Torque sensors
- 10) Displacement sensors
- 11) Strain sensors
- 12) High-frequency optical sensors
- 13) Cosmic ray sensors
- 14) Atmospheric pressure sensors
- 15) Direct optical vision sensors
- 16) IR/UV radiometry sensors

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CONFIDENTIAL

The U.S. Government is currently conducting a study of the optical properties of various types of glass. This study is being conducted in order to determine the best type of glass for use in various types of optical instruments. The study is being conducted by the U.S. Army Research Office, Durham, North Carolina.

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The only remedy is to have at least one source of such glass within the U.S. This is because the kinds of optical glass are available in various sizes, the techniques for producing

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Several phases of the program are being conducted in parallel. The first phase is the development of a theoretical model of the system. This model will be used to predict the performance of the system under various operating conditions. The second phase is the construction of a physical model of the system. This model will be used to verify the predictions of the theoretical model. The third phase is the construction of a computer simulation of the system. This simulation will be used to study the system's behavior under various operating conditions.

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b. Optics Science Facility

The proposed facility is an optical science facility. It is centered around a large 100-in. diameter telescope. The facility will have a capability for performing research in the field of optics.

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1. The first of these is the fact that the majority of the population of the United States is now living in urban areas. This is a result of the process of urbanization, which has been going on since the beginning of the 20th century. The process of urbanization is the movement of people from rural areas to urban areas. This movement is caused by a number of factors, including the search for better living conditions, the desire for education and employment opportunities, and the attraction of urban areas by the concentration of industry and commerce. The result of this process is that the majority of the population now lives in urban areas, which are characterized by a high density of people and a high level of economic activity. This has led to the development of a new type of urban area, the metropolitan area, which is a large area of land surrounding a central city. The metropolitan area is characterized by a high density of people and a high level of economic activity, and it is the center of a large region. The metropolitan area is the result of the process of urbanization, and it is the center of a large region. The metropolitan area is the result of the process of urbanization, and it is the center of a large region.

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[illegible]

35000

1. The first phase of the mission is the reconnaissance of the target area. This is done by the reconnaissance aircraft, which will fly at a low altitude and use its cameras to take photographs of the target area. The reconnaissance aircraft will also use its radar to detect any enemy forces in the area. The reconnaissance aircraft will then report its findings to the command center.

2. The second phase of the mission is the attack on the target area. This is done by the attack aircraft, which will fly at a low altitude and use its weapons to attack the target area. The attack aircraft will also use its radar to detect any enemy forces in the area. The attack aircraft will then report its findings to the command center.

3. The third phase of the mission is the withdrawal of the aircraft. This is done by the aircraft, which will fly at a low altitude and use its engines to withdraw from the target area. The aircraft will also use its radar to detect any enemy forces in the area. The aircraft will then report its findings to the command center.

4. The fourth phase of the mission is the establishment of the reconnaissance aircraft. This will be on the order of 1000 hours.

Low-Altitude Photogrammetry

In order to avoid early detection by enemy forces, the aircraft must penetrate enemy defenses. This is done by the aircraft, which will fly at a low altitude and use its engines to penetrate enemy defenses. The aircraft will also use its radar to detect any enemy forces in the area. The aircraft will then report its findings to the command center.

SECRET

APPENDIX A

GLOSSARY

Asymmetric information - Information that is not available to all parties to a transaction.

Angular resolution - The angle subtended at the source by the angular separation.

Apodization - A technique wherein transmission at the aperture is modified, usually by electronic means, to improve the resolution of the system. This is done by varying the transmission across the aperture, resulting in a diffraction pattern that has a higher percentage of the total energy in the center spot and a lower percentage in the diffraction rings. However, the size of the center spot becomes slightly larger, which in some cases greatly decreases the resolution of low-contrast details.

Area search - Reconnaissance performed for tracking and identifying potential targets.

Aspheric - A term used to describe an optical surface which is neither a section of a sphere nor of a plane.

Beverage antenna - A long-wave low-frequency sublight-time antenna placed close to the ground. It normally is used in approximately 3-mi lengths.

Bolometer - Device whose resistance changes in accordance with changes in temperature used in the measurement of microwave energy. It contains a resistive element, the resistance of which changes as a result of heating by RF power.

Catadioptric optic systems - Optical systems which contain both reflective (mirror) and refractive (lens) elements.

COBOL - Common Business Oriented Language

Cold war - The use of political, economic, technological, sociological, psychological, and military measures short of overt armed conflict involving regular military forces to achieve national objectives. Cold war includes periods of increased international tension, accelerated paramilitary activities, and increased activity by military forces.

*JCS definition

SECRET

Collection - Activity whereby information is accumulated. For example, documents, may be collected or sensors may be used to collect information on a particular target. This term is also used to describe the gathering of information by means of a mobile platform, such as a ship, aircraft, or satellite, or by means of a fixed or mobile platform, such as a ship, aircraft, or satellite, or by means of a fixed or mobile platform, such as a ship, aircraft, or satellite.

Counterforce military warfare - Offensive operations conducted by armed forces and/or nonmilitary agencies of an established government and/or its allies against the military forces.

Counterinsurgency (COIN) - The entire range of military, paramilitary, political, economic, psychological, and civil actions taken by or with the government of a nation to defeat insurgency (primarily associated with civil war).

Cryostat - A device used to lower temperature by putting a gas at high pressure through a small aperture into a space of lesser pressure.

Data base - An established body of information which serves as a background against which new information may be compared, evaluated, and/or used in planning.

Decibel milliwatts (dBM) - $10 \log_{10} (\text{power out}) / (1 \text{ milliwatt power in})$

Decibel watts (dBW) - $10 \log_{10} (\text{power out}) / (1 \text{ watt power in})$

Ephemeris (pl. ephemerides) - A table giving the position or assumed position of artificial heavenly bodies as a function of time.

Excorrelation - Correlation of information from intelligence records (i.e., locations shown in photos, signal analysis, etc.) with other available data for synthesis in the production of an intelligence estimate.

Extraction - From the standpoint of intelligence functions extraction constitutes the first phase or task in obtaining information from a record to be used as a basis for subsequent exploitation and analysis.

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CORURAN - An acronym for "Computerized Reporting and Analysis" (IBM common alphanumeric computer language).

Delisted - A subject eliminated from a file which means that it is not to be kept over a prolonged period - delivery of the subject is to be limited.

General War - Armed conflict between the major powers or the communist and free worlds in which the total resources of the military, police and employed and the national survival of a major nation are in jeopardy.

Ground resolution - The size of the smallest object on the ground that can be distinguished on a sensor record by the interpreter.

Ground truth - Data which describes the true situation on the ground at the time that reconnaissance sensor data is collected. This information consists of verifications, confirmation, and description of target and background as well as meteorological data.

Guerrilla warfare (GW) - Combat operations conducted generally in enemy-held territory by predominantly indigenous forces on a military or paramilitary basis to reduce the combat effectiveness, (industrial, economic, political, and military war potential), and morale of the enemy.

Hard copy - A finished copy - directly readable.

Identification - The degree of detail that permits determination of the general characteristics of an object and the function that may be performed.

Imbibed emulsions - Photographic materials which include light-sensitive components and most of the required developing chemicals.

Intelligence - The product resulting from collecting, evaluating, analyzing, integrating, and interpreting all available information which concerns one or more aspects of foreign nations or of areas of operations and which is immediately or potentially significant to military planning and operations.

*JCS definition

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Insurgency, Level of -

Phase I. This phase involves a group of individuals or individuals who have achieved only a potential for action (General media), but not yet achieved any actual action. This phase is the initial subversion of the established authority. This phase is the first of an organized process. It involves a major disruption of violence or an organized insurgent movement.

Phase II. This phase is reached when the subversive movement has gained sufficient local or regional support to include organized guerrilla warfare or organized forms of violence against the established authority.

Phase III. The transition moves from Phase II to Phase III when the insurgency becomes primarily a war of movement between organized forces of the insurgents and those of the established authority.

Light amplification by stimulated emission of radiation.

Limited war - Armed conflict short of general war, exclusive of incidents involving the complete engagement of the military forces of two or more nations.

Mapping and geodesy - The collection of high-accuracy reconnaissance data for producing accurate maps or actual or potential battle areas and for accurate target location. The geodesic aspect usually implies determinations such as location of bench marks to establish datum relationships, gravity anomaly measurements, etc.

Meta-language - A language used to describe other languages and the translations between them.

Mission - The broad purpose or basic character of an organization.

Monobath web - A porous carrier material which serves a chemical reaction that will develop and fix a photographic image on exposure.

Nanosecond - A measurement of time equal to 10^{-9} seconds.

Neutralization - Action taken against an enemy element rendering it incapable of performing its mission. Neutralization includes killing or destroying.

JCS definition

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IIA-4

Interval - The interval between two events or a time period between two events.

Reconnaissance - A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrological or geographical characteristics of a particular area.

Real time - A measurement of time for an action or reaction which is on an ongoing basis.

Reconnaissance - A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrological or geographical characteristics of a particular area.

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Reconnaissance mission

Area Search - Reconnaissance performed for detecting and identifying potential targets.

Operational - Reconnaissance performed in sufficiently fine detail to permit identifying objects previously detected in area of interest.

Objective - Reconnaissance performed to provide the detail necessary to permit analysis of specific targets, including their technical aspects.

Reconnaissance system - All aspects of reconnaissance from data acquisition or collection through data processing, communication and extraction.

Reconnaissance, tactical air - The collection by aerial vehicles of information on terrain, weather, electronic and communications emissions and on air, sea, and ground forces or establishments, lines of communications, and other factors as required to plan and conduct tactical military operations.

*JCS definition

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Reconnaissance, weather - Personnel capable of observing weather data over areas where weather reports from other sources are not available or to obtain immediate knowledge of weather conditions along the routes to and from the vicinity of targets and to conduct air operations.

Signal intelligence analysis - The use of signal information such as intercepts of signal intercepts, voice intercepts, and communications to determine capabilities, status, activity, intentions, and disposition.

Spectral warfare - Spectral warfare encompasses electromagnetic operational, communications, electronic, conventional warfare, and psychological warfare. Although the words and sub-operation associated with each type of activity are often similar, spectral warfare is primarily associated with electronic warfare, whereas conventional warfare is primarily associated with kinetic warfare or general war operations. Psychological warfare is a most important factor throughout the entire spectrum of cold, limited, and general war.

Square angle - The angle between the two major face axes of a cube - frequency ratio of two.

Sight angle - The angular difference between the axis of an antenna radiation and a selected geometric axis, such as the axis of the reflector.

Strategic warning - A notification that enemy-initiated hostilities may be imminent. The time element may vary from minutes to hours, days, or more.

System - A composite of personnel, equipment, skills, and techniques intended to perform and/or support an operational role. A complete system includes vehicles and all associated related vehicles, sensors, equipment, materials, services, and the personnel required for its operation to the degree that it can be considered a self-sufficient unit in its intended operational and/or support environment.

Tactical warning - Notification that the enemy has initiated hostilities. Such warning may be received any time from the launching of the attack until it reaches its target.

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Target description - A single description of the performance which must exist in order for the target to be destroyed, incapacitated, or rendered unusable.

Requirement - A statement of the specific action or condition which must be achieved in order to accomplish the mission.

Task - From a major military organization capability which is a specific assignment (derived from the capability) from the strategic or a major element within the capability to that of the sub-capability whereby a certain function must be accomplished.

Technical intelligence - The evaluation and product resulting from collection of information collected by appropriate means concerning the organization of the enemy or elements in all technical intelligence being furnished by a country.

Unconventional warfare - Includes the three interrelated fields of guerrilla warfare, sabotage, and subversion against the enemy. Unconventional warfare operations are conducted within enemy or enemy-controlled territory by paramilitary intelligence personnel usually supported and directed to varying degrees by an external source and are primarily associated with limited war or general war conditions.

Up converter - The type of parametric amplifier which is characterized by the frequency of the output signal being greater than the frequency of the input signal.

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